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ABSTRACT

This guide for the planning and construction of recreational facilities is divided into the following five parts: (a) fundamental procedures, (b) indoor facilities, (c) sport and athletic facilities, (d) recreational and park areas and facilities, and (e) indoor and outdoor swimming pools. Part one concerns planning the facility and dealing with the architect, and contains a check list for planners. The second part is the most extensive and includes chapters on facilities for (a) elementary and secondary schools, (b) colleges and universities, (c) research, (d) faculty and staff, and (e) lockers and showers. It also discusses construction features for the handicapped, lighting, and trends in facility concepts. Part three concerns fields, courts, field houses, and stadiums. Part four discusses (a) community involvement, (b) indoor and outdoor community areas, and (c) camps and camping. The last part deals with design and planning considerations for construction of indoor and outdoor swimming pools. Appendixes include a glossary and an annotated bibliography of areas and facilities in education and recreation. (RC)

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FOREWORD

At a meeting of the Board of Directors of the American Association for Health, Physical Education and Recreation, held in Washington, D.C., in April, 1945, favorable action was taken on a proposal by Caswell M. Miles, AAHPER Vice-President for Recreation, that a grant of money be obtained to finance a national conference on facilities. Subsequently, a request for $10,000 to finance the first facilities workshop was placed before Theodore P. Bank, president of The Athletic Institute. At a later meeting of the Board of Directors of The Athletic Institute, the project was approved and the money appropriated to finance the first workshop.

The National Conference on Facilities for Health, Physical Education and Recreation was formed for the purpose of organizing and conducting the workshop. The members of the Conference Executive Committee included representatives of the several national organizations co-sponsoring the project.

Twenty-nine years have elapsed since the printing of the first **Guide** which resulted from the first workshop, held at Jackson's Mill, West Virginia, in December, 1946. Since then there have been 12 printings of the **Guide**.

The second workshop was held May 5-12, 1956, at the Kellogg Center for Continuing Education, Michigan State University, East Lansing. The second workshop, like the first, was financed by The Athletic Institute. The 1956 edition of the **Guide**, which resulted from the second workshop, has been widely used in planning and constructing facilities.

The third workshop, which was financed jointly by the AAHPER and The Athletic Institute, was held January 15-24, 1965, at the Biddle Continuing Education Center, Indiana University, Bloomington. The 1965 edition of the **Guide**, which was prepared by the third workshop, has been well-received throughout the country.

During recent years, there have been many new developments in facility planning and construction. These have been due to a number of factors. The need for improving education, recreation and fitness opportunities for the youth of the nation has been highlighted by many groups. The fine work of the President's Council on Physical Fitness is one illustration of the growing national interest in health, physical education and recreation activities. Much of the research and attention devoted to facility planning and construction during the past 30 years has been due to the increased leisure time in our society and a growing realization that recreation and especially physical activity, is a fundamental human need essential to the well-being of all people.

At the 1965 facilities workshop, there was an expressed interest in the need for a **Guide** on college facilities. It was pointed out that the earlier **Guides** had been directed toward community and school use. Although some attention was given to basic college needs by those attending the 1965 workshop, the participants agreed that a college and university **Guide** should be prepared at a subsequent workshop. As a result, AAHPER and The Athletic Institute again agreed to finance such a project and the dates of April 29-May 8, 1967, were set for the fourth workshop.

The delegates for the 1967 workshop were carefully selected on the basis of their particular knowledge and contributions. Among those invited were a number of outstanding college and technical personnel engaged in planning and conducting programs of athletics, recreation, outdoor education, and physical and health education. In addition, invitations were extended to a number of specialists responsible for planning and constructing facilities for these programs. These specialists included city planners, architects, landscape architects, engineers and schoolhouse construction consultants.

Early in the planning, chairmen were selected for the various workshop committees. These committees were busily engaged in conducting research and gathering data before the workshop, which was again held at the Biddle Continuing Education Center at Indiana University.

Workshop participants approached the task of preparing the new **Guide** from the standpoint that adequate programs of athletics, recreation, outdoor education, and physical and health education can be provided only through co-operative planning directed toward the most economical and efficient use of the total resources. Every effort was made to incorporate the most recent advances in facility planning and construction. At the same time, an attempt was made to identify new needs and to anticipate future ones.

At the 1974 facilities committee meeting, there was an express concern that the **Guide** be changed to meet the needs of a new era in construction. Five committee members were assigned the task of restructuring the **Guide** in such a way that it would serve as a more practical tool for school administrators, physical education department heads, architects, planning consultants and all others who may either be interested in planning new areas and facilities or checking the adequacy of those already in use.

Appreciation is extended to all those who contributed their time, effort and materials to make possible this latest revision of the **Guide**.

It has been a team project, and, therefore, the publication does not necessarily represent the viewpoint of any one individual or the organizations they represent. It represents the composite knowledge of the finest individuals and organizations in the United States whose expertise revolves around facility planning and construction.

Dr. Harold K. Jack
(1906-1972)

Dedication

This facilities guide is dedicated to the fond memory of Dr. Harold K. Jack, professor of Health, Physical Education and Recreation at Temple University, Philadelphia, Pennsylvania, who died November 11, 1972 in his 67th year.

Dr. Jack was a scholar of the first magnitude in his academic field. The many honors and awards received by him testify to his talent, service and contribution to fields of health, physical education and recreation.

At the time of his death, he chaired the committee organized to prepare and publish this guide. His knowledge of facilities planning was truly outstanding.

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Part One-Fundamental Procedures

Chapter 1

THE PLANNING PROCESS

MAN FUNCTIONS as a total organism. Every experience, every learning leaves its imprint upon his totality. Each makes changes not only in his mental and physical being but also in his emotional and social attitudes. Because of this interrelationship and interplay among all the facets of man, it is impossible to fractionalize his being. However, for the purpose of clarity, this Guide will categorize some of the needs of man, although it is understood that whether he is reading, working, visiting, swimming, or fishing, he is functioning as a totality and is being changed accordingly. Changes in man never cease from the cradle to the grave.

Through the ages, man has adapted himself to his environment very well; otherwise, he would have become extinct like many prehistoric animals. Modern man, however, faces a more rapidly changing environment than his forefathers. Even though much of this change has been brought about by man himself, he has a very difficult time adapting to his new situations. The impact of less physical activity, more leisure, confusing propaganda, conflicting ideologies, and everyday threats of disasters and wars has confronted man with myriads of mental, physical, and social strains in spite of the progress of medicine.

It is apparent that the solution to many of these problems is proper preparedness through education. For fruitful and purposeful living, man must be an active participant in more phases of educational and recreational endeavors and experiences than those found merely in the classroom during his school years. Thus this Guide is devoted to the needs and desirable facilities for those highly specialized educational fields known as athletics, physical education, and recreation. These closely related fields are making great contributions to the physical and mental health and well-being, as well as the happiness and longevity, of man. These three fields must be given proper consideration in all phases of planning, whether districtwide, countywide, statewide, or nationwide.

BASIC CONSIDERATIONS

Before considering the planning of areas and facilities essential for athletics, physical education, and recreation, it is important to understand the basic aims and objectives of these fields.

Athletics and Physical Education

The aim of athletics and physical education is to help people of all ages live healthy, satisfying, and energetic lives. Four specific purposes are: (a) to develop and maintain maximum physical efficiency (b) to develop useful knowledge and physical skills (c) to act in socially useful ways and (d) to enjoy wholesome physical recreation.

The subject matter of athletics and physical education is the science and skill of movement. All types of sports and activities are used to develop in youth and adults the strength, endurance, coordination, and flexibility essential in both work and play. Through activities, boys and girls, youth, and adults are taught the physical skills needed for performing daily work; they are trained and conditioned through exercise and sports for the maintenance of mental and physical health; they are taught the skills of those physical activities that form a part of leisure pursuits.

A sound school activity program includes required daily teaching and participation in appropriate and diversified activities for all pupils, a wide variety of intramural activities available to all, and at the senior high school level, a broad program of interscholastic athletics for those of superior athletic ability.

Recreation

The primary function of recreation is the enrichment of living by enabling individuals to find outlets for self-expression and thereby to develop their inherent potential and achieve desired satisfactions. These satisfactions include adventure, fellowship, a sense of accomplishment, the enjoyment of beauty, and the joy of creating, all of which contribute to human happiness. Through recreational programs, people are helped to develop interests and skills that enable them to make constructive use of leisure and that contribute to physical and mental health, safety, good citizenship, confidence, and character development.

Recreation is essentially a kind of experience rather than a set of specific activities. Many types of these experiences have a major place in programs of schools and colleges as well as recreation agencies. The wide range of recreational activities includes games and sports, music, dance, arts and crafts, drama, social activities, nature and outing activities, hobbies, and service projects. The comprehensive recreational program affords people of all ages, backgrounds, and interests the opportunity to engage in a variety of activities with the help of trained leaders and under conditions that assure maximum enjoyment and benefits. Activities are offered both indoors and outdoors, near people's homes and at more distant places, and year-round as well as seasonally.

NEED FOR AREAS AND FACILITIES

Increased emphasis on education—not just for making a living, but for living—has accelerated the acceptance of the importance of athletics, physical education, and recreation. The evolution of these functions within the school, college, and total community has focused attention on their relationships, their common denominator, their interdependence, and the need for enlightened cooperation and joint planning. Basic in the development of optimum services and opportunities, both for learning and for translating learning into practice and full living, are suitable areas and facilities—specialized and general, indoor and outdoor.

The widening impact of athletics, public recreation, and physical education has aroused public consciousness to the importance of more and improved provision for programs and services in athletics, physical education, and recreation. It has also directed attention to the unmistakable need for additional areas and facilities to meet the growing demand and enable these programs and services to function fully and effectively.

Physical education, as the education of the whole human being, and the drive for fitness to live and function effectively and zestfully in an environment of speed, change, and tension have captured the public consciousness. Public interest in a wide range of recreational activities has had a phenomenal growth, as reflected, for example, in the demand for facilities required for organized camping, water and winter sports, and the performing arts. Schools and colleges have increasingly accepted the responsibility for teaching skills that contribute to the satisfying use of leisure.

NEED FOR PLANNING

Functional planning of areas and facilities for athletics, physical education, and recreation has become a task of great magnitude. In the acquisition and development of these areas and facilities, the need for sound planning is imperative. Its importance cannot be overemphasized. Wise planning in these fields helps assure successful programs, facilitates the work of the teaching and leadership staff, and enables children, youth, and adults to enjoy full benefits from participation.

In any locality where population growth is evident or where school, college, and recreational facilities require expansion, land should be acquired or set aside for future school sites and recreational areas. The space requirements of such areas need to be determined in the light of projections of population growth as far into the future as can be calculated reasonably, and land should be acquired as early as possible before the needed sites are developed for other uses. Land acquisition that occurs after the need becomes obvious is likely to be too late and the amount too little. Many cities that have failed to acquire suitable areas when they were available and in advance of actual need have been obliged later to settle for inadequate, poorly located sites and have paid far more for them than they would have if earlier action had been taken. Little time is available for long-range planning in localities with unusual population growth. Even where the growth is normal, the demand for urgency or expediency often prevents the development of sound plans.

When the need for acquiring areas or developing indoor or outdoor facilities has been recognized by the appropriate governing body, sound planning procedures must be followed. The planning of functional facilities for athletics, physical education, and recreation must be geared to meet not only present but future needs, as far ahead as they can reasonably be predicted. Since new structures may well be used for at least fifty years, building plans must be as functional and adaptable as possible to permit changes for varying program needs. Otherwise, desired modifications may be impossible or may create inconvenience, reduction in program, and excessive cost.

PLANNING FACTORS

A careful determination of the specific needs to be met by the area or facility should be the first step in the planning process. Planning can be effective only if the major purpose of the proposed areas and facilities is clearly defined and interpreted. Since they are provided to facilitate the attainment of specific objectives and to make possible the conduct of definite programs, the objectives and programs must be determined before areas and facility plans are developed. It cannot be emphasized too strongly that the program should dictate the types of areas and facilities.

Among the factors to be considered are the activities to be carried on, the ages and skills of the participants in the program, and the seasons or periods of use. Since both physical education and recreation programs are subject to change and modification, and since they vary in different localities, standardized or stock plans for areas and facilities are rarely practicable. Unless variations in local interests and needs are taken into account in formulating plans, the resulting properties may prove inadequate or unsuited to the effective conduct of the program. The guiding principles associated with total planning follow:

- **Every Community Needs Areas and Facilities for Physical Education, Athletic, and Recreational Programs.** These programs, which are essential to the well-being of the people, cannot be effective unless a wide variety of indoor and outdoor facilities is provided. In addition to their importance to the programs, these facilities help enhance and maintain sound community values.
- **Every Community Requires a Master Plan Based on a Study of Its Needs.** Preparation of this plan is the primary responsibility of established planning agencies. Provisions for a system of properties required for physical education and recreation must be included in the master plan. The adoption and enforcement of regulations for zoning, land use, and subdivision control are essential to the implementation of the plan.
- **The Type, Location, and Size of Essential Areas and Facilities Must Be Related to the Total Community Pattern.** They vary in residential areas of different types and densities and are affected by the location of thoroughfares, business and industrial districts, transportation lines, and other natural barriers.
- **Areas and Facilities Should Be Planned in Relation to the Social and Economic Characteristics of the Community.** The feasibility of providing specific programs in a particular locality is influenced by the interests and financial resources of its total population.
- **Areas and Facilities Should Be Planned with Due**

Regard for the Full Potential Use of Existing and Available Physical Resources. Plans for land acquisition and development can be justified as economically sound only if they are related to an inventory of comparable resources in the community or region. Duplication of facilities and overlapping of services are thereby avoided, and a maximum return from expenditures for areas and facilities can be expected.

- **Areas and Facilities Should Make Possible Programs That Serve the Interests and Needs of All the People.** Consideration should be given to the special needs of persons of all ages and both sexes. Resulting programs should comprise a wide range of activities, including not only sports and athletics, but also arts and crafts, music, drama, dance, camping and outdoor education, social recreation, hobbies, and many others. In view of the increasing proportion of the population in the older-age group, particularly the retired, special consideration of the needs of senior citizens is desirable. Facilities should also make it possible for disabled citizens, young and old, to participate in most aspects of physical education and recreational programs.
- **Plans for Areas and Facilities Must Conform to State and Local Regulations and, as Far as Possible, to Accepted Standards and Practice.** Planning groups should become familiar with fire, building, electrical, sanitary, and other pertinent codes and make sure that their plans conform to them. Otherwise, unnecessary expense may be incurred in making changes required to secure official approval. Standards developed through research and experience serve as a guide to planning, even though local situations may not permit their application without modification.
- **Close Cooperation Among All Public and Private Agencies Concerned with the Location, Acquisition, Development, and Operation of Areas and Facilities Designed for Athletics, Physical Education, and Recreation Is of the Utmost Importance.** Such cooperation involves not only school, park, recreation, and city planning agencies, but also redevelopment authorities and public and private housing agencies, among others. An interagency planning committee can be an effective means of achieving cooperative action. The legal, financial, and administrative powers and responsibilities of each cooperating agency must be defined, understood, and mutually respected.
- **All Interested Organizations, Individuals, and Groups Should Have An Opportunity To Share in the Planning of Areas and Facilities Intended for Public Use.** Wide participation in the consideration of proposals requiring the expenditure of public funds for areas and facilities gives the people an opportunity to express their desires and needs and helps assure their support of the projects and their use of the areas and facilities when made available.
- **Full Use Should Be Made of the Knowledge and Experience of Individuals Who Are Qualified To Give Expert Advice and Assistance in Planning Areas and Facilities.** School, park, and recreation department personnel in a wide variety of positions can contribute materially to the determination of the features to be included and can offer valuable suggestions for their design and development. Individuals with professional training and technical competence, such as landscape architects, architects, engineers, and sociologists, can play major roles in overall planning and in the design of areas and facilities.
- **Every Available Source of Property or Funds Should Be Explored, Evaluated, and Utilized Whenever Appropriate.** Tax funds are a primary source, but large numbers of areas and facilities have been acquired or built, entirely or largely, by gifts from individuals or organizations. Localities should take advantage of state and federal funds available for planning and for acquisition and improvement of school and recreation areas.
- **Widespread Publicity, Sound Interpretation, and Public Discussion Facilitate the Implementation of Area and Facility Plans.** Appropriate authorities, community groups, and the public-at-large need to be fully informed if acceptance and support are to be achieved.

PLANNING UNITS—TYPES AND FUNCTIONS

Publicly owned areas and facilities within the scope of this Guide are principally under the jurisdiction of two types of local authorities—school districts and departments of parks and recreation. Other public and quasipublic agencies provide such facilities as libraries and museums. Privately owned facilities, such as churches, settlement houses, and youth clubs also contribute to the public service. The total effect of these facilities upon services for athletics, physical education, and recreation varies in different cities. In some localities they play a major role, but whatever their extent their presence must always be taken into account in planning areas and facilities. The real value of the public services hinges largely upon the qualifications of the personnel employed and the nature and quality of the facilities controlled and used by the school and the department of parks and recreation.

Comprehensive programs and services require that indoor and outdoor areas and facilities of many kinds, shapes, and sizes be available throughout the year. Each area and facility has a special function and serves specific uses. These areas and facilities are classified in this Guide according to function, and their sizes are determined by the nature of their services and the number of people to be served. Understanding of this classification is essential to effective planning.

In planning a system of interrelated areas and facilities, as advocated in this Guide, each type of geographic area—neighborhood, community, city, school district, county, region, state, and nation—must be considered. In some instances, the entire state must be included, and when accessible, areas and facilities provided by the federal and state governments must be taken into account.

The Neighborhood

The neighborhood is a residential area with homogeneous characteristics, of a size comparable to that usually served by an elementary school. A typically ideal neighborhood for planning purposes would be an area three-fourths of a mile to a mile square and containing about 6,000 to 8,000 people.

Population densities of neighborhoods vary from a few thousand to many thousands per square mile. There is also a wide variation in the number of children. Therefore, each neighborhood must be studied carefully. Because most residents live within a short distance of the school or playground, they walk to it and tend to use it frequently, often for shorter periods than in the centers planned for a larger geographic unit.

The Community

The community is a section of a city, primarily a residential area. It usually represents the service area of a high school, contains a business center, and commonly constitutes a section of the city measuring two or three miles across. It can be thought of as a "community of neighborhoods" because it is usually composed of three to five neighborhoods.

The City or School District

The area designated as the city, town, borough, or village lends itself to the provision of areas and facilities for use by the entire population of the political subdivision. Major parks, golf courses, camps, museums, and botanical gardens, which cannot be provided in each neighborhood and community, are typical citywide areas. In small localities comprising one community and a single high school, citywide planning is comparable to planning for a single community as described above, although some facilities commonly provided in larger citywide areas are included.

School districts vary widely in size and population, but districtwide school planning involves primarily neighborhoods and communities. Some of the large school districts provide districtwide facilities for an outdoor education-recreation complex, interscholastic activities, consolidated educational programs, and some type of post-high school center or community college for day pupils.

Larger Units

The county or the region, which is a geographic area that sometimes includes parts of more than one county, is increasingly used as a unit for recreation planning. Many of these planning units are located close to a metropolitan area and include both the city and the surrounding region. Others are primarily rural in nature and are composed primarily of unincorporated areas. Planning on a regional or district basis lends itself to the provision of extensive properties usable for family outings, winter and water sports, and other activities requiring large land and water areas. Since these properties are distant from dense population centers, people require transportation in order to reach them and, consequently, tend to use them less frequently but for longer periods than is true of the areas in the smaller planning units.

THE PARK-SCHOOL CONCEPT

Before the various types of properties that are commonly included in comprehensive plans are described, the current trend toward providing areas that serve for both education and public recreation deserves special mention.

The park-school as described in this Guide is the most desirable type of major facility in the neighborhood or community for day-by-day use in organized programs of athletics, recreation, and physical education. It combines the neighborhood recreational area and the elementary school site; the community recreational area and the secondary school site.

The concept is greater than just a grouping of these facilities on a single site. It is a unit, the wholeness of which is its essential characteristic. It is an outdoor-indoor plant functionally designed to house and make possible an integrated program of education, recreation, and community activities suitable to the geographic area it serves. In addition to the resulting economy in land acquisition and use, construction, operation, and maintenance, it represents a wholeness of environment in which integrated living in education, recreation, and community life takes place.

The park-school is an example of cooperative action between school and municipal authorities. It involves a joint agreement as to the location, development, and use of properties to be designed for the school athletic and physical education program and for the recreation of both school and community groups. Since the park-school concept is based on the desirability and economy of dual use, it is of the utmost importance that plans be developed jointly by both school boards and municipal authorities responsible for park and recreational services. In order to protect the interests of the cooperating authorities and to assure the most effective application of the park-school plan, a formal agreement should be drawn up and signed by both agencies, specifying their respective responsibility for the purchase, development, operation, maintenance, and use of the facilities.

Although the park-school concept has won wide acceptance in recent years, separate school sites and municipal recreational areas are still being acquired in many communities. While one reason may be lack of knowledge of the concept, more frequently it is because the school or municipal authorities fail to recognize the advantages and economy of the plan or are unwilling to subordinate their prerogatives under a cooperative program.

Possibly the concept of the park-school program, which leads to the designation of the park-school as the basic functional facility, can best be expressed by suggesting that it should be related to the idea of a "community curriculum" of education-recreation. The program is developed and directed through the joint efforts of the agencies and organizations actually concerned with meeting the needs of children, youth, and adults. The park-school presumes the inclusion of the programs of these organizations. In its design and operation, therefore, the park-school becomes a day-by-day laboratory for training in cooperative democratic citizenship through integration of education and recreation for people of all ages.

The park-school concept also encompasses lands and facilities more remote from densely populated centers and possibly outside the city or township boundary. Such an outdoor education-recreation complex makes it possible to conduct extended programs in an outdoor environment.

Community Park-School

The community park-school is an area on which are located a junior or senior high school and a variety of recreational and physical education facilities designed for both school and community use. It should be centrally located in the community it is to serve and provide a parklike environment. If it contains a senior high school, it requires more acreage than if it is associated with an elementary or junior high school, and its service radius is appreciably greater. Many of the people using such centers, especially those with a senior high school, reach them by automobile or public transport. Relatively few live close enough to walk to them. A portion of the area is usually developed as a playground for the children living in the immediate neighborhood, while another portion serves as a landscaped park.

The function of this area is similar to that of the neighborhood park-school. While the neighborhood park-school contains an elementary school and serves primarily children, the community park-school contains a secondary school and serves primarily young people and adults. The geographic area served by the community school is larger (usually consisting of three or more residential neighborhoods), its space requirements are much greater, and it provides facilities not feasible in the neighborhood unit because of the cost and needed space. The community park-school with a senior high school needs more area in order to provide for scholastic athletics, spectator space, and extensive parking.

In communities where the park-school plan cannot be put into effect, separate sites are required for the secondary schools—the junior and senior high schools. A smaller site will serve the needs of the school physical education, recreation, and outdoor education programs better than if the area were also expected to provide the recreational service for the entire community. The senior high school needs a larger site than the junior high school because the enrollment is usually higher and because of the greater space requirements of the interscholastic athletic program. Even though separate public indoor and outdoor recreational facilities are provided elsewhere in the community, the junior and senior high school plants should be designed so as to facilitate community use when they are not required for school purposes.

Outdoor Education-Recreation Complex

A land area or a cluster of acreages suitable for more extensive outdoor education-recreation programs, owned by the school district, city, or township, is an important adjunct of the park-school. Such a complex should be located as near the city as possible, yet should include some of the following: a resident camp; extensive nature trails; primitive areas for outpost camping and exploration; an outdoor skills and sports center; and plots for forestry and wildlife management, pioneer and modern farms, and other uses.

The Community Room

The community room is probably most representative of the community park-school program in that it is designed specifically to meet community needs. The community room should be at least as large as a regular classroom. Kitchen facilities, including stove, refrigerator, cupboards, tables, and chairs, help to make it an ideal meeting place for civic and social organizations.

Since community schools are centrally located in each geographic area, the community room is readily accessible for use by all residents of the area. Here, under auspices of the community school, neighbors become acquainted and plan the activities in which they would like to participate. The community room may be used during the day for adult club meetings or casual recreational activities. In the evening, it may be used for adult classes or as a meeting place for community groups. Frequently, the community council, made up of representatives of all groups in the neighborhood, meets in the community room to discuss programs for the area served by the school.

The need for intelligent and cooperative planning by all agencies, especially school and municipal authorities, was never greater than at present. Cost of acquisition, construction, development, operation, and maintenance, as well as efficiency in use, will depend heavily upon the degree of cooperative endeavor and farsightedness. Sights must be raised immeasurably if present and future needs are to be met. The time for careful, imaginative long-range planning is now—in fact, it was yesterday!

Chapter 2

WORKING with the ARCHITECT

A good building efficiently and comfortably designed, like positive results in sports, can evolve only from a well-coordinated team effort. The team should consist of individuals well-versed in the facts and realistic objectives concerning their project. The architect is only one member of the team, and the earlier he can begin working with the planning team the better. On an effective team each member must have the knowledge, the authority, and the decisiveness to reach and build upon decisions. Ideally, the members of the planning team should be the ones who are ultimately going to use the spaces being planned. The architect can be an umpire, listener, leader, provocateur, synthesizer, and expert—but always a part of the team.

SELECTING THE ARCHITECT

Selecting the right architect is not a simple matter. Important considerations are his knowledge and past experience as well as his personality and ability to establish rapport. The clients should interview prospective architects, view their work, inspect buildings they have designed, and confer with other clients they have served. An architect's ability to provide good service must be questioned from many standpoints. Ideally, the entire planning team should participate in the selection of an architect, asking questions to confirm his competency and his compatibility with their objectives.

STARTING TO WORK

Once the architect is selected, the whole team can be assembled. It should be representative but not cumbersomely large. It should include the architect and perhaps a consultant expert in the requirements of the problem at hand.

The first meetings are critical. A constructive pattern of positive accomplishments should be established. The planning team should outline specific and comprehensive program requirements, determine sizes, designate functions, and delineate operational patterns. Meetings should be scheduled regularly, and the committee should follow agendas, and notes should be taken, kept, and reviewed. Various solutions should be considered to substantiate the validity of ultimate decisions. Personalities must be soothed, compromises met, plain reason and soaring imagination both considered. The process should be enjoyable, for it may be a once-in-a-lifetime opportunity to achieve something that began as thoughts, then words, then drawings, and finally was built!

The architect will be developing and revising increasingly detailed drawings as the meetings progress. To insure steady progress, it is essential that the drawings be developed progressively, each with more detail than the last, but not ever changing the basic concepts. The basic concept developed in preliminary drawings should be evaluated very carefully. Architects usually provide their services in phases called programming, schematic design, design development, construction documents, bidding documents, and construction, and their service fees are proportionately related. Approval is sought for one phase before work begins on the next. Abandoning a concept in its later phases can be time-consuming and costly both to the architect and to the client.

FOLLOWING THROUGH

It is essential that the drawings be understood by everyone. Some people have great difficulty in interpreting drawings and are sometimes too embarrassed to ask for aid. Explanations should be thorough, even if they sometimes seem agonizingly basic. Three-dimensional models can help to increase comprehension of the relationship of wall heights to room volumes. Model furniture or miniature figures can contribute to appreciation of room sizes.

As the drawings progress and the total idea of the actual building develops, specific materials and finishes should be considered and chosen. The committee should view either representative samples or actual installations of like materials.

The more each team member knows before actual construction begins, the fewer surprises and, therefore, the less potential for disappointment. Planning, drawing, material selection, and building are a step-by-step progression, each building on cumulative decisions.

When the building is ready to use, the true test of all planning comes. If the building works well, looks well, wears well, and can accommodate change, then the team has done its job well and can with great satisfaction enjoy its accomplishment. The everyday inhabitants for whom it was planned come now, and the theories of use and hundreds of other decisions will get their daily tests. It is very probable that the building's ability to be flexible will be tried out early.

All may not be perfect. However, if the planning team did their job well, kept their users in mind and informed, and sought good value and function, they will have a useful and enjoyable facility.

Chapter 3

CHECK LIST for FACILITY PLANNERS

As an aid to those responsible for planning facilities for athletics, physical education, and recreation, a check list has been prepared. The application of this check list may prevent unfortunate and costly errors.

Place the appropriate letter in the space indicated in the right-hand margin after each statement.

A—The plans meet the requirements **completely**.

B—The plans meet the requirements **only partially**.

C—The plans **fail** to meet the requirements.

Soundly conceived plans for areas and facilities are not achieved by chance or accident, but by initiative and action of knowledgeable people acting individually, in groups, and as agencies.

GENERAL

1. A clear-cut statement has been prepared on the nature and scope of the program, and the special requirements for space, equipment, fixtures, and facilities have been dictated by the activities to be conducted. ______
2. The facility has been planned to meet the total requirements of the program as well as the special needs of those who are to be served. ______
3. The plans and specifications have been checked by all governmental agencies (city, county, and state) whose approval is required by law. ______
4. Plans for areas and facilities conform to state and local regulations and to accepted standards and practices. ______
5. The areas and facilities planned make possible the programs that serve the interests and needs of all the people. ______
6. Every available source of property or funds has been explored, evaluated, and utilized whenever appropriate. ______
7. All interested persons and organizations concerned with the facility have had an opportunity to share in its planning (professional educators, users, consultants, administrators, engineers, architects, program specialists, building managers, and builder—a team approach). ______
8. The facility and its appurtenances will fulfill the maximum demands of the program. The program has not been curtailed to fit the facility.
9. The facility has been functionally planned to meet the present and anticipated needs of specific programs, situations, and publics. ______
10. Future additions are included in present plans to permit economy of construction. ______
11. Lecture classrooms are isolated from distracting noises. ______
12. Storage areas for indoor and outdoor equipment are of adequate size. They are located adjacent to the gymnasiums. ______
13. Shelves in storage rooms are slanted toward the wall. ______
14. All passageways are free of obstructions; fixtures are recessed. ______
15. Facilities for health services and the first-aid and emergency-isolation rooms are suitably interrelated. ______
16. Buildings, specific areas, and facilities are clearly identified. ______
17. Locker rooms are arranged for ease of supervision. ______
18. Offices, teaching stations, and service facilities are properly interrelated. ______
19. Special needs of the physically handicapped are met, including a ramp into the building at a major entrance. ______
20. All "dead space" is used. ______
21. The building is compatible in design and comparable in quality and accommodation to other campus structures. ______
22. Storage rooms are accessible to the play area. ______
23. Workrooms, conference rooms, and staff and administrative offices are interrelated. ______
24. Shower and dressing facilities are provided for professional staff members and are conveniently located. ______
25. Thought and attention have been given to making facilities and equipment as durable and vandalproof as possible. ______
26. Low-cost maintenance features have been adequately considered. ______
27. This facility is a part of a well-integrated master plan. ______
28. All areas, courts, facilities, equipment, climate control, security, etc., conform rigidly to detailed standards and specifications. ______
29. Shelves are recessed and mirrors are supplied in appropriate places in rest rooms and dressing rooms. ______
30. Dressing space between locker rows is adjusted to the size and age of students. ______
31. Drinking fountains are conveniently placed in locker-room areas or immediately adjacent thereto. ______
32. Special attention is given to provision for locking service windows and counters, supply bins, carts, shelves, and racks. ______
33. Provision is made for the repair, maintenance, replacement, and off-season storage of equipment and uniforms. ______
34. A well-defined program for laundering and cleaning towels, uniforms, and equipment is included in the plan. ______
35. Noncorrosive metal is used in dressing, drying, and shower areas except for enameled lockers. ______
36. Antipanic hardware is used where required by fire regulations. ______
37. Properly placed hose bibbs and drains are sufficient in size and quantity to permit flushing the entire area with a water hose. ______
38. A water-resistant, coved base is used under the locker base and floor mat, and where floor and wall join. ______
39. Chalkboards and/or tackboards with map tracks are located in appropriate places in dressing rooms, hallways, and classrooms. ______
40. Book shelves are provided in toilet areas. ______
41. Space and equipment are planned in accordance with the types and number of enrollees. ______
42. Basement rooms, being undesirable for dressing, drying, and showering, are not planned for those purposes. ______
43. Spectator seating (permanent) in areas that are basically instructional is kept at a minimum. Roll-away bleachers are used primarily. Balcony seating is considered as a possibility. ______
44. Well-lighted and effectively displayed trophy cases enhance the interest and beauty of the lobby. ______
45. The space under the stairs is used for storage. ______
46. Department heads' offices are located near the central administrative office, which includes a well-planned conference room. ______
47. Workrooms are located near the central office and serve as a repository for departmental materials and records. ______
48. Conference area includes a cloak room, lavatory, and toilet. ______
49. In addition to regular secretarial offices established in the central and department-chairmen's offices, a special room to house a secretarial pool for staff members is provided. ______
50. Staff dressing facilities are provided. These facilities may also serve game officials. ______
51. The community and/or neighborhood has a "round table" for planning. ______
52. All those (persons and agencies) who should be a party to planning and development are invited and actively engaged in the planning process.
53. Space and area relationships are important. They have been carefully considered. ______
54. Both long-range and immediate plans have been made. ______

55. The body comfort of the child, a major factor in securing maximum learning, has been considered in the plans.
56. Plans for quiet areas have been made.
57. In the planning, consideration has been given to the need for adequate recreational areas and facilities, both near and distant from the homes of people.
58. Plans recognize the primary function of recreation as being enrichment of learning through creative self-expression, self-enhancement, and the achievement of self-potential.
59. Every effort has been exercised to eliminate hazards.
60. The installation of low-hanging door closers, light fixtures, signs, and other objects in traffic areas has been avoided.
61. Warning signals—both visible and audible—are included in the plans.
62. Ramps have a slope equal to or greater than a one-foot rise in 12-feet.
63. Minimum landings for ramps are 5 by 5 feet, they extend at least one foot beyond the swinging arc of a door, have at least a six-foot clearance at the bottom, and have level platforms at 30-foot intervals on every turn.
64. Adequate locker and dressing spaces are provided.
65. The design of dressing, drying, and shower areas reduces foot traffic to a minimum and establishes clean, dry aisles for bare feet.
66. Teaching stations are properly related to service facilities.
67. Toilet facilities are adequate in number. They are located to serve all groups for which provisions are made.
68. Mail services, outgoing and incoming, are included in the plans.
69. Hallways, ramps, doorways, and elevators are designed to permit equipment to be moved easily and quickly.
70. A keying design suited to administrative and instructional needs is planned.
71. Toilets used by large groups have circulating (in and out) entrances and exits.

CLIMATE CONTROL

1. Provision is made throughout the building for climate control—heating, ventilating, and refrigerated cooling.
2. Special ventilation is provided for locker, dressing, shower, drying, and toilet rooms.
3. Heating plans permit both area and individual-room control.
4. Research areas where small animals are kept and where chemicals are used have been provided with special ventilating equipment.
5. The heating and ventilating of the wrestling gymnasium have been given special attention.

ELECTRICAL

1. Shielded, vapor-proof lights are used in moisture-prevalent areas.
2. Lights in strategic areas are key-controlled.
3. Lighting intensity conforms to approved standards.
4. An adequate number of electrical outlets are strategically placed.
5. Gymnasium and auditorium lights are controlled by dimmer units.
6. Locker-room lights are mounted above the space between lockers.
7. Natural light is controlled properly for purposes of visual aids and avoidance of glare.
8. Electrical outlet plates are installed three feet above the floor unless special use dictates other locations.
9. Controls for light switches and projection equipment are suitably located and interrelated.
10. All lights are shielded. Special protection is provided in gymnasiums, court areas, and shower rooms.
11. Lights are placed to shine between rows of lockers.

WALLS

1. Movable and folding partitions are power-operated and controlled by keyed switches.
2. Wall plates are located where needed and are firmly attached.
3. Hooks and rings for nets are placed (and recessed in walls) according to court locations and net heights.
4. Materials that clean easily and are impervious to moisture are used where moisture is prevalent.
5. Shower heads are placed at different heights—four feet (elementary) to seven feet (university)—for each school level.
6. Protective matting is placed permanently on the walls in the wrestling room, at the ends of basketball courts, and in other areas where such protection is needed.
7. An adequate number of drinking fountains are provided. They are properly placed (recessed in wall).
8. One wall (at least) of the dance studio has full-length mirrors.
9. All corners in locker rooms are rounded.

CEILINGS

1. Overhead-supported apparatus is secured to beams engineered to withstand stress.
2. The ceiling height is adequate for the activities to be housed.
3. Acoustical materials impervious to moisture are used in moisture-prevalent areas.
4. Skylights, being impractical, are seldom used because of problems in waterproofing roofs and the controlling of sun rays (gyms).
5. All ceilings except those in storage areas are acoustically treated with sound-absorbent materials.

FLOORS

1. Floor plates are placed where needed and are flush-mounted.
2. Floor design and materials conform to recommended standards and specifications.
3. Lines and markings are painted on floors before sealing is completed (when synthetic tape is not used).
4. A coved base (around lockers and where wall and floor meet) of the same water-resistant material used on floors is found in all dressing and shower rooms.
5. Abrasive, nonskid, slip-resistant flooring that is impervious to moisture is provided on all areas where water is used —laundry, swimming pools, shower, dressing, and drying rooms.
6. Floor drains are properly located, and the slope of the floor is adequate for rapid drainage.

GYMNASIUMS AND SPECIAL ROOMS

1. Gymnasiums are planned so as to provide for safety zones (between courts, end lines, and walls) and for best utilization of space.
2. One gymnasium wall is free of obstructions and is finished with a smooth, hard surface for ball-rebounding activities.
3. The elementary school gymnasium has one wall free of obstructions, a minimum ceiling height of 18 feet, a minimum of 4,000 square feet of teaching area, and a recessed area for housing a piano.
4. Secondary school gymnasiums have a minimum ceiling height of 22 feet; a scoreboard; electrical outlets placed to fit with bleacher installation; wall attachments for apparatus and nets; and a power-operated, sound-insulated, and movable partition with a small pass-through door at one end.
5. A small spectator alcove adjoins the wrestling room and contains a drinking fountain (recessed in the wall).
6. Cabinets, storage closets, supply windows, and service areas have locks.
7. Provisions have been made for the cleaning, storing, and issuing of physical education and athletic uniforms.
8. Shower heads are placed at varying heights in the shower rooms on each school level.
9. Equipment is provided for the use of the physically handicapped.
10. Special provision has been made for audio and visual aids, including intercommunication systems, radio, and television.
11. Team dressing rooms have provisions for the following:
    - a. hosing down room
    - b. floors pitched to drain easily
    - c. hot- and cold-water hose bibbs
    - d. windows located above locker heights
    - e. chalk, tack, and bulletin boards, and movie projection
    - f. lockers for each team member
    - g. drying facility for uniforms.
12. The indoor rifle range includes the following:
    - a. targets located 54 inches apart and 50 feet from the firing line
    - b. three to eight feet of space behind targets
    - c. 12 feet of space behind firing line
    - d. ceilings eight feet high
    - e. width adjusted to number of firing lines needed (one line for each three students)
    - f. a pulley device for target placement and return
    - g. storage and repair space.
13. Dance facilities include the following:
    - a. 100 square feet per student
    - b. a minimum length of 60 linear feet for modern dance

c. full-height viewing mirrors on one wall (at least) of 30 feet; also a 20 foot mirror on an additional wall if possible ______
d. acoustical drapery to cover mirrors when not used and for protection if other activities are permitted ______
e. dispersed microphone jacks and speaker installation for music and instruction ______
f. built-in cabinets for record players, microphones, and amplifiers, with space for equipment carts ______
g. electrical outlets and microphone connections around perimeter of room ______
h. an exercise bar (34 to 42 inches above floor) on one wall ______
i. drapes, surface colors, floors (maple preferred), and other room appointments to enhance the room's attractiveness ______
j. location near dressing rooms and outside entrances. ______

14. Training rooms include the following:
a. rooms large enough to administer adequately proper health services ______
b. sanitary storage cabinets for medical supplies ______
c. installation of drains for whirlpool, tubs, etc. ______
d. installation of electrical outlets with proper capacities and voltage ______
e. high stools for use of equipment such as whirlpool, ice tubs, etc. ______
f. water closet, hand lavatory, and shower ______
g. extra hand lavatory in the trainers' room ______
h. adjoining dressing rooms ______
i. installation and use of hydrotherapy and diathermy equipment in separate areas ______
j. space for the trainer, the physician, and for the various services they provide ______
k. corrective-exercise laboratories located conveniently and adapted to the needs of the handicapped. ______

15. Coaches' rooms provide the following:
a. a sufficient number of dressing lockers for coaching staff and officials ______
b. a security closet or cabinet for athletic equipment such as timing devices ______
c. a sufficient number of showers and toilet facilities ______
d. drains and faucets for hosing down the rooms where this method of cleaning is desirable and possible ______
e. a small chalkboard and tackboard ______
f. a small movie screen and projection table for use of coaches to review films. ______

Part Two-Indoor Facilities

Chapter 1

FACILITIES for ELEMENTARY and SECONDARY SCHOOLS

INDOOR FACILITIES for physical education and athletics should be planned and constructed so that the desired educational programs can become a reality. In an era of change in national and world cultures, responsible persons must endeavor to anticipate needed program changes in both the near and the distant future.

The task of planners is to ascertain the indoor space requirements of the school and the community for physical education and athletics and to translate these needs into the number, size, type, and location of facilities. The location of areas most frequently used for community recreational purposes should be considered in relation to each other for safety, economic operation, program expansion, and the adequate protection of school property:

- The location of teaching stations or play areas in relation to each other, and each to its appropriate service unit, should permit coeducational activity and meet other program needs.
- The location of indoor service facilities should be such that they are readily accessible to persons using the outdoor areas during the school year as well as during vacation periods.
- The location and adequacy of sanitary and storage facilities to accommodate spectator or recreation groups should be carefully planned.
- The locker, shower, and dressing-room area should be planned for the safety, comfort, and convenience of its users.

The planners of indoor facilities should give attention to the following general concepts:

- The involvement of both men and women staff members of the physical education and recreation departments is essential in planning for all related facilities.
- To provide adequate variety in the physical education curriculum, it may be necessary to plan more than a gymnasium, depending upon the kinds of skills, knowledge, and attitudes to be emphasized. In a school for kindergarten through third grade only, a room smaller than a gymnasium may be used, unless it is also a neighborhood center where older members of the community gather for recreation.
- While a single facility may meet the instructional needs of the physical education program, additional space will be necessary if all students are to be given an opportunity to participate in an intramural and/or interscholastic program.
- To expand the basic program in physical education, it is desirable to have such additional special facilities as bowling alleys, swimming pools, and archery and rifle ranges. It may be possible for the school to secure some of these facilities through the cooperative use of existing or proposed facilities owned and administered by some other agency.
- As planning for recreation is considered, the entire school plant becomes a potential space resource, and all units should be scrutinized and planned with recreational adaptability in mind. Since community schools are centrally located in each neighborhood, they provide excellent facilities in which to carry out a wide range of educational and recreational activities. Isolation and retained accessibility of units to permit recreational use during a variety of hours is important.
- The best planning of indoor facilities will require a careful study of the community's unique characteristics—its attitudes, economic conditions, climate, topography, population, existing facilities, program demands—and the use of creative imagination by the planners.

The personnel teaching physical education should be involved in planning for the facility. Teachers, supervisors, and knowledgeable people in the community should be consulted.

Good planning will include considerations of many factors. The staff should review the curriculum and the space needs as well as needs for certain specialty areas. Such service facilities as general storage areas, locker rooms, offices, and storage areas for specific teaching stations must also be considered. The number of teaching stations should be computed, based on the projected enrollment of the school. An estimate of the number of square feet allocated to physical education should be realistic in terms of needs of the department. Much time and effort is needed to program each teaching station or other specific unit for the architect. If the initial planning is properly done, the architect will know what is needed and his plans will reflect the thinking of the staff.

TEACHING STATIONS

A fundamental concept with respect to the facilities of any school is that the unit of primary importance is the room or space where teaching [illegible]. All other parts of the school plant are, in a real sense, secondary. In physical education, therefore, the determination of the number and character of the teaching stations is basic to the planning process.

The term *teaching station* is used to mean any room or space where one teacher can instruct or supervise the learning experience of one class or group of students. For instance, a gymnasium would constitute a teaching station, or if divided, it could provide two or more teaching stations. Swimming pools, auxiliary physical education teaching stations, and rhythm rooms are examples of other kinds of teaching stations. The number of students accommodated by a teaching station is controlled by the nature of the specific activity as well as the size of the facility.

The total number of teaching stations required is dictated by enrollment, policies pertaining to instructional physical education, average class size, diversity of program, number of periods in the school day, and other uses of the facilities. Planners should be aware that indoor facilities for physical education, athletics, and recreation are difficult and costly to expand at some future date. The ultimate enrollment potential should be determined by research procedures used by school planners. The anticipated enrollment of the school five to ten years after completion of construction should serve as a basis for determining the required number of teaching stations to be provided in the original construction. Long-range planning is imperative to provide for the logical and most economical expansion to accommodate the ultimate enrollment potential. The initial design should make provisions for the anticipated construction. This practice will enhance the acceptance of future building programs.

Thorough studies to determine ultimate enrollment potential also serve as the basis for identifying the desirable site size. Otherwise, expansion will create a loss of outdoor space at a time of actual increase in need. Immediately upon completion of construction, planning should begin to identify expansion needs.

ELEMENTARY SCHOOL INDOOR ACTIVITY AREAS

The biological demands of the body require that the normal child engage in at least three hours of vigorous motor activities daily. Not only does the instructional physical education program endeavor to fulfill part of this basic need, but it also seeks to develop motor skills that will lead to enjoyable physical activities during leisure.

The elementary school physical education program centers around the teaching of fundamental skills, rhythmics or dance, games and sports, gymnastic activities, combatives, self-testing activities, and aquatics. The design and scope of physical education facilities should be based upon these activities. They should also consider the needs of the disabled child.

Teaching Stations for Elementary School Physical Education

Elementary school physical education classes may be organized by a number of methods. The average class size is usually based on the number of pupils in the classroom unit. Because of differences in pupil maturation, physical education periods generally vary from 20 minutes for kindergarten and first grade to 40 minutes for fifth and sixth grades, with the school average (for computation purposes) being 30 minutes per class.

The formula for computing the number of teaching stations needed for physical education in an elementary school is as follows:

$$\text{Minimum Number of Teaching Stations} = \text{Number of Classrooms of Students} \times \frac{\text{Number of Physical Education Periods per Week per Class}}{\text{Total Number of Physical Education Class Periods in School Week}}$$

Example: a. Number of classrooms of students—school contains grades 1 to 6, three classrooms for each grade level, or a total of 18 classroom units.

b. Number of physical education periods per week per class—a period for physical education each school day during the week equals five periods per week.

c. Total number of physical education class periods in school week—there is a total of five instructional hours in the school day, and the length of physical education periods is 30 minutes; thus, a total of ten 30-minute periods each school day may be scheduled for physical education or a total of 50 periods for the five-day school week.

The teaching station needs would be calculated as follows:

$$\text{Minimum Number of Teaching Stations} = \text{18 Classroom Units} \times \frac{\text{5 Periods per Week}}{\text{50 Periods per Week}}$$

$$= \frac{90}{50} = 1.8$$

Under the circumstances set forth above, the need is indicated for two teaching stations, which will accommodate the 18 daily classes and allow two periods for flexibility. (Each computation that results in a fraction must be raised to the next whole number.) To provide more flexibility, it is suggested that no more than eight periods per day or 40 periods per week be used as the base. If the school day is less than five hours, adjustments must be made in the total periods per week.

Teaching-station needs must be studied in terms of the number of students to be accommodated and the desired variety in an excellent physical education program. For example, in planning for an elementary school a small gymnasium should be provided, and an auxiliary gymnasium and pool might also be included as teaching stations. One or two additional playrooms are usually needed in larger elementary schools. Multipurpose rooms and cafeteria-gymnasium combinations have been found to be most impractical for physical education, especially from the standpoint of scheduling. In the latter case, tables need to be set up before the lunch hour and the entire area needs to be cleaned after the lunch period. Usually, the area is not available for physical education from 10:30 a.m. to 2:30 p.m.

The Gymnasium

The elementary school gymnasium is used primarily, but not exclusively, by the upper grades. A minimum of 100 square feet per pupil and a total of at least 4,000 square feet is recommended. Spectator seating, if provided, and storage rooms require additional space. Many of the general considerations recommended later in this chapter for secondary school gymnasiums also apply to elementary school facilities.

The specific dimensions of the gymnasium should provide

TABLE 1
SPACE FOR SELECTED INDOOR ACTIVITIES IN SCHOOLS

Activity	Play Area in Feet	Safety Space in Feet*	Total Area in Feet
Badminton	20 x 44	6s, 8e	32 x 60
Basketball			
Jr. High instructional	42 x 74	6s, 8e	
Jr. High interscholastic	50 x 84	6s, 8e	
Sr. High interscholastic	50 x 84	6s, 8e	62 x 100
Sr. High instructional	45 x 74	6s, 8e	57 x 90
Neighborhood El. Sch.	42 x 74	6s, 8e	54 x 90
Community Junior H. S.	50 x 84	6s, 8e	62 x 100
Community Senior H. S.	50 x 84	6s, 8e	62 x 100
Competitive—DGWS	50 x 94	6s, 8e	62 x 110
Boccie	18 x 62	3s, 9e	24 x 80
Fencing, competitive	6 x 40	3s, 6e	12 x 52
instructional	3 x 30	2s, 6e	9 x 42
Rifle (one pt.)	5 x 50	6 to 20e	5 x 70 min.
Shuffleboard	6 x 52	6s, 2e	18 x 56
Tennis			
Deck (doubles)	18 x 40	4s, 5e	26 x 50
Hand	16 x 40	4½s, 10e	25 x 60
Lawn (singles)	27 x 78	12s, 21e	51 x 120
(doubles)	36 x 78	12s, 21e	60 x 120
Paddle (singles)	16 x 44	6s, 8e	28 x 60
(doubles)	20 x 44	6s, 8e	32 x 60
Table (playing area)			9 x 31
Volleyball			
Competitive and adult	30 x 60	6s, 6e	42 x 72
Junior High	30 x 50	6s, 6e	42 x 62
Wrestling (competitive)	24 x 24	5s, 5e	36 x 36

*Safety space at the side of an area is indicated by a number followed by "e" for end and "s" for side.

for a basketball court of 42 by 64 feet, with a minimum safety space of six feet around the perimeter. An area of 54 by 76 feet—4,104 square feet—would be adequate. The ceiling should be a minimum of 18 feet high. This space is adequate for activities normally included in the elementary school program. If the gymnasium is to serve the community recreational program, the ceiling height should be increased to 22 feet and the playing floor enlarged to accommodate older groups (see Table 1). The area could be divided into units of 38 by 54 feet and thus provide two teaching stations for primary classes or for activities that do not require large areas.

A storage room of 175 square feet should be directly accessible from the gymnasium floor through a double door without a threshold. At least one wall should be free of obstruction for ball and target games and skill practice. Attachments must be provided for backboards, ropes, and apparatus. Basketball backboards should be adjustable so that the height of the basket rim can be raised or lowered according to the maturation of the participants.

Service Facilities

Shower and dressing rooms should be provided to enable students to change clothes and to take a shower after physical education classes. These facilities are also required for community use of the gymnasium or outdoor play areas. Shower-dressing-locker facilities are considered in detail in Part Two, Chapter 5.

Storage space for equipment used in the auxiliary gymnasium is discussed later in this chapter. Additional space is required for equipment used outdoors. The room for the equipment should be easily accessible to the outdoors and should also be near the staff offices. Space to store out-of-season equipment is essential to prevent loss or misplacement between seasons. Storage areas should have bins, shelves, racks, and hangers for the best utilization of space and the proper care of equipment and supplies.

An office for the physical education staff should be located near the gymnasium and equipment-storage rooms. It should be a minimum of 100 square feet in size, with an adjoining room containing a shower, toilet, and lavatory. This unit could be used by the physical education staff, whether permanent or visiting, and by persons directing noon or after-school recreational programs. Schools having two teaching stations should provide separate offices for a man and a woman.

Auxiliary Physical Education Teaching Station(s)

The elementary school auxiliary physical education teaching station supplements the main gymnasium. It is often called a play room. It is most practical when the main gymnasium cannot fulfill all of the school's needs for teaching stations. The auxiliary unit should be planned to accommodate limited apparatus and tumbling activities, games of low organization, rhythmics, and other activities for the primary grades. This room will, for the most part, be used by the lower grades and, therefore, should be accessible to their classrooms. If the area is to serve the after-school recreational program for pupils or is to be used by community groups, a drinking fountain should be located nearby in a corridor, and accessible toilet facilities are desirable. Extended use of the area would be enhanced by some degree of isolation.

SPECIFICATIONS

At least 60 square feet per primary pupil, with a total minimum of 1,800 square feet of space, is suggested for this unit. A ceiling height of 18 feet in the clear is preferred, although lower ceilings may be used. One wall should be free of obstruction so that it may be used for target and ball games or throwing practice. A smooth masonry wall will provide an adequate rebounding surface. If included, windows should be of breakproof glass or be protected by a shield or grill and be located high enough so as not to restrict activities.

The equipment could include such items as climbing ropes and poles, ladders, mats, stall bars, rings, large wooden boxes, horizontal bars, and peg boards. These should be located so as not to interfere with other activities or so they may be easily moved out of the way. A storage room for equipment and supplies should be included. A section of wall can be equipped with hangers for mat storage. Electrical outlets are required for the use of record players and similar sound equipment.

PROGRAMMING FOR CONSTRUCTION OF A PHYSICAL EDUCATION PLAYROOM (SAMPLE)

1. *Use of Playroom.* The area should be suitable for grades K-3 for simple games, relays, stunts, singing games, and rhythms.
2. *Size.* The area should be a rectangle measuring approximately 50 by 40 feet, providing 2,000 square feet of space.
3. *Ceiling.* The ceiling should be acoustic, 12 to 14 feet high (all beams and supports above the minimum height), with suitable fixtures attached to the beams to support hanging equipment.
4. Walls. Walls should be of concrete block, smooth (no obstructions), and solid so that targets may be painted on walls for drills for throwing and kicking.
5. *Floor.* The base should be solid concrete slab, carpeted with pad between carpet and concrete.
6. *Lighting.* Fluorescent lighting should supply 40 to 50 footcandles on the floor, and a switch should be installed at each door. Light fixtures should be guarded to prevent breakage. Additional lighting should be provided (controlled from switch in the equipment room) if instant playback equipment is to be used.
7. *Windows.* Windows should be placed on only one side of the room, to provide natural light. They should be covered with a protective screen to prevent breakage. Window sills should be six feet above the floor.
8. *Electrical Outlets.* Outlets should be installed on each wall, each a double-service unit.
9. *Equipment Storage Area.* At least 200 to 300 square feet should be provided for storage. Cabinets and shelves should be installed. The equipment room should have a double door, so that wide equipment may be stored and moved in and out easily. A telephone for emergency use should be placed in the equipment room.
10. *Mirrors.* Three full-length mirrors should be placed at one end of a wall, side by side, for visual analysis of movement.
11. *Bulletin Board.* Cork board should be hung on the wall near the entrance for posting materials and schedules.
12. *Drinking Fountain.* One should be placed on a wall in the corridor just outside the door to the playroom.
13. *Speakers.* Two matched speakers should be placed high on the wall or in the ceiling. Jack plugs should be installed on each wall to use for speaker input from appropriate units.
14. *Paint.* Walls should be painted off-white or a very pale color.
15. *Other Items.* If the building is equipped with closed-circuit TV, two outlets should be provided for receiver. There should be a separate entrance for recreational use.
   - The teaching station should be isolated from other parts of the building for evening functions.

Adapted Teaching Stations

An adapted teaching station should be provided in all elementary schools. It should be rectangular in shape and should contain at least 1,200 to 1,500 square feet. The ceiling should be 12 to 14 feet in height. A storage room for equipment such as mats, weights, balance beams, and bars should be attached to the area. Adapted physical education is considered a must in modern elementary physical education.

Dance Areas*

Dance areas for elementary school children should be large enough to accommodate approximately 30 students. Rooms below ground are inadvisable because of possible dampness and lack of adequate ventilation. As increasing numbers of elementary schools are built on a one-floor plan, with outdoor exits for individual classrooms, basement facilities will gradually vanish.

Hardwood is advised for dance floors. Tile floors, which frequently are laid directly on cement or concrete, are cold to the touch and often slippery. Because tile flooring has no resiliency, it is conducive to painful injuries.

There is no universal type of dance facility that should be provided. Except under unusual circumstances, economics rule out the provision for a dance studio. The combination gymnasium-cafeteria is not recommended because of scheduling difficulties and the health hazards of dust on food and lunch debris in the activity area. The stage-auditorium, stage-gymnasium, small gymnasium, multipurpose room, or large playroom may be used if adequate electrical outlets and wiring for record players, tape recorders, and minimal stage lighting can be provided.

*This section is adapted from the following: American Association for Health, Physical Education, and Recreation. *Dance Facilities*: Washington, D.C.: the Association, 1972.

The rather informal dance programs presented at the elementary school level can often be accommodated by seating the children on the floor and the visitors on chairs around three sides of one end of the dance area. Usually, storage space for recordings and simple percussion equipment is available in or adjacent to such areas. Many physical education items can be used in the dance program. Jump ropes, balls, boxes, benches, mats, and other play apparatus lend themselves to creative uses.

Dance for children has become an established activity in elementary school programs. It can only take place, however, when space and equipment are provided, time is allocated, and leadership is available.

SECONDARY SCHOOL INDOOR ACTIVITY AREAS*

Teaching Stations

The type and number of indoor teaching stations for a secondary school depends on the number of students enrolled and the specific program of physical education and related activities. In all situations, a gymnasium is required. Other teaching stations, if necessary, are planned to supplement the gymnasium, but all are planned after careful consideration of the facility needs of the total program.

TEACHING STATIONS FOR SECONDARY SCHOOL PHYSICAL EDUCATION

By determining the number of teaching stations essential for the formal program of instruction, planners will have a basis for calculating other needs. Computation of the minimum numerical requirement is achieved by the following formula:

$$\text{Minimum Number of Teaching Stations} = \frac{\text{Number of Students}}{\text{Average Number of Students per Instructor}} \times \frac{\text{Number of Physical Education Periods per Week per Class}}{\text{Total Number of Physical Education Class Periods in School Week}}$$

If a school with a projected enrollment of 700 students has six class periods a day with an average size of 30 students, and physical education is required on a daily basis, the formula application is as follows:

$$\text{Minimum Number of Teaching Stations} = \frac{\text{700 Students}}{\text{30 per Class}} \times \frac{\text{5 Periods per Week}}{\text{30 Periods per Week}}$$

$$= \frac{3500}{900} = 3.9$$

The fraction is rounded to the next highest number, making four teaching stations the minimum required. This number of units would also afford some flexibility in class scheduling.

*Physical education facilities for the middle school should follow the standards for secondary schools.

In computing teaching-station requirements for the secondary school, the desired class size must not be set so low as to require an impossible number of teachers and facilities, nor should it be so high that effectiveness is impaired. An average class size of 30 is recommended for secondary schools. Daily instruction for all girls and boys is recommended. However, if the physical education classes meet only two periods per week, the total number of class periods per week in the formula must be adjusted accordingly.

TEACHING STATIONS FOR OTHER ACTIVITIES

The next step for planners is to determine the degree to which the number of teaching stations for the program of instruction will meet the needs for voluntary recreation, extramural and intramural activities, and interscholastic athletics for girls and boys, as well as the possible use of facilities by the community. The needs must be based upon the season of the year representing the greatest demand for facilities.

The following guide can be used to determine the number of teaching stations needed for activities other than the formal program of instruction in physical education:

Minimum number of teaching stations, or fractions thereof, needed for interscholastic-team practice at peak load, plus

Minimum number of teaching stations, or fractions thereof, needed for intramural and extramural activities, plus

Minimum number of teaching stations, or fractions thereof, needed for student recreation, plus

Minimum number of teaching stations, or fractions thereof, needed for community recreation, equals

The total number of teaching stations needed for any specific after-school period.

To illustrate, assume a school has two interscholastic squads, an intramural program, a voluntary recreation group, and no community recreational use of facilities immediately after school during a specific season. The total needs are as follows:

Required teaching stations = 2 interscholastic + 1 intramural + 1 voluntary recreation = 1 stations.

The need for four teaching stations for the after-school program must then be compared to the number necessary for the formal program of instruction in physical education. If the after-school needs are in excess of those for the regular periods of instruction, the additional teaching stations should be provided. Careful administrative scheduling results in maximum utilization of facilities.

To clarify the situation, a chart may be prepared using the principle outlined above. Such a chart would list all of the after-school activities for boys and girls sports, for recreation, and for other activities, as in the following example:

VARIETY OF TEACHING STATIONS

A great variety of teaching stations is possible, depending on the number of different activities that would appropriately be included in the physical education program. Among the possible types of indoor teaching stations that might be included are gymnasiums, rhythm rooms, rooms for gymnas-

TABLE 2.

INDOOR EXTRACURRICULAR FACILITIES NEEDED

Name of Activity	Units Needed for Total After-School Periods Per Week	
Varsity Basketball	5	5
J. V. Basketball	5	-
Gymnastics	5	5
Volleyball	-	5
Intramurals	5	5
Student Recreation	3	3
Faculty Recreation	2	2
Track and Field	5	-
Wrestling	5	-
Dance	-	5
Sub-Total	35	25

Total=60 full after-school periods per week or 12 stations.

Note: The above chart represents the needs of a large high school with representative teams. If the after-school period is long enough, the periods may be split. Keep in mind that all of the above activities are usually scheduled before the evening meal hour.

tics, adapted physical education rooms, wrestling rooms, classrooms, swimming pools, archery ranges, rifle ranges, and handball courts.

The problem for some schools is not lack of an adequate number of teaching stations, but rather lack of facilities to accommodate the desired variety of activities. For a secondary school with 360 students, a divisible gymnasium will create an adequate number of teaching stations for the program of instruction in physical education but may not meet the peak-load requirement for after-school activities. The facility must be planned and designed to serve all program needs as adequately as possible.

Whenever a school's teaching requirements are such that a basic gymnasium is inadequate, planners should consider special-purpose stations, such as an auxiliary physical education teaching station, a natatorium, or a dance studio.

Secondary School Gymnasium

The building or portion of the school that houses the gymnasium should be located so that it is easily accessible from classrooms, parking areas, and the outdoor activity area. A proper location not only provides accessibility, but also makes possible use of the facility after school hours or during weekends or holidays without having to open other sections of the school.

SIZE AND LAYOUT

For general purposes, allow a minimum of 125 square feet of usable activity space for each girl or boy in a physical education class at peak load. The space requirements and dimensions of a gymnasium floor are most significantly influenced by the official rules governing court games, particularly interscholastic basketball, and the extent of spectator seating. The minimum dimensions required of a gymnasium for basketball, however, should be expanded, if necessary, to accommodate other activities. In some instances, an entire gymnasium is not required for an activity. Folding, soundproof partitions can be used to divide the area and thereby provide two teaching stations, each of which should have the minimum area for an individual teaching station.

WALLS AND CEILINGS

The walls of the gymnasium should be of a material that is resistant to hard use, at least to door height. The finish should be resistant to marking and scarring and should have a smooth, non-abrasive surface. All corners below door height should be rounded, and there should be no projections into playing areas. Lower portions of the walls should be finished with materials that can be easily cleaned without destroying the finish.

The following are recommended ceiling heights: junior high school, 20 feet for instruction and 22 feet for interscholastic athletics; senior high schools, 22 feet. All heights should be measured to the lowest point of the ceiling. Ceilings should be insulated to prevent condensation of moisture and should be of a light color to enhance light reflection. Acoustic ceiling materials are necessary in all areas, especially in dance studios and areas accommodating spectators.

FOLDING PARTITIONS

Folding partitions make possible two or more teaching stations in the gymnasium. They should be power-operated, insulated against sound transmission and reverberation, and so installed as to permit compensation for building settlement. The control should be key-operated. The design and operation must ensure student safety. Partitions should extend from floor to ceiling and may be recessed when folded. Floor tracks should not be used. A pass door should be provided at the end of a partition. When partitions are installed in gymnasiums with open truss construction, the space between the top of the folding doors and the ceiling should be insulated against sound transmission.

FIXED EQUIPMENT

If suspended equipment is planned, provision for its attachment should be made before the ceiling is installed.

Basketball backstops will need special care in their installation to ensure rigidity and safety. All basketball backstops should be attached to ceilings or walls, and swing-up or fold-up models should be used where the backstops might interfere with other activities. An adapted mechanical device can be helpful in the operation of swing-up or fold-up models. In addition to the main-court basketball backstops, provision should be made for other backstops on clear sidewalls.

In the interest of safety, such suspension apparatus as bars, rings, and climbing poles and ropes should be so placed as to allow sufficient clearance from basketball backstops and walls. If wall apparatus is desired in the gymnasium, a strip of metal or hardwood firmly attached to the wall at the proper height is recommended. Wherever necessary, floor plates should be installed for fastening movable equipment such as horizontal bars and volleyball standards.

If mats are to be hung in the gymnasium, appropriate hangers should be provided. For safety reasons, padding should be installed on all walls in back of baskets. Rubber-tired mat trucks, which may be wheeled into a storage room, have been found quite satisfactory in many places.

SPECTATOR SEATING

The extent of the demand for spectator seating depends upon each school and the community it serves. Junior high schools do not have as extensive spectator activities as do senior high schools. Under no circumstances should the program facilities be cut in order to finance spectator accommodations. Modern design uses power-driven folding or roll-away bleachers, which telescope and thereby require insignificant permanent space. If possible, the outer surface of folding bleachers should create a flat, wall-like surface so that it may be used for ball rebounding.

The number of seats that can be provided on the main floor level by roll-away bleachers is directly related to the length of the floor and the distance between the side of the court and the adjacent wall. The width of each seating space should not be less than 18 inches. Roll-away bleachers most commonly allow 22-inch depths for seats. A greater depth would provide increased comfort. The number of rows available in roll-away bleachers varies among manufacturers, with 23 rows being the maximum for standard equipment. In some instances, bleachers with 30 rows can be secured by special order. Planners should investigate local and state codes and those of the National Fire Protection Association, 60 Battery March Street, Boston, Mass.

Electrically powered tractors with rubber tires are manufactured for pulling bleachers into position for occupancy and for folding them away. The tractor not only allows one man to do the job, but provides uniform and steady power and avoids the danger of having a group of energetic young men apply their efforts to the task. Other types of power-driven devices are also available.

The maximum number of removable seats that can ordinarily be provided at floor level is from 3,000 to 3,100, using 23 rows 100 feet long on both sides of the basketball court. An area of 110 by 165 feet could house these facilities. Balconies can be used to increase the total seating capacity beyond the maximum permitted at floor level. The space at both levels should be considered as activity area when the bleachers are closed. It may be desirable, in some instances, to provide less than maximum seating at floor level so that a balcony will be wide enough to serve as a teaching station for specific activities. Balcony bleachers can be installed to telescope from the back to the front so that in the closed position they stand erect, creating a divider wall at the edge of the balcony. This arrangement affords partial isolation of the teaching station and enhances the safety of participants.

TRAFFIC CONTROLS

Good traffic control should permit the efficient movement of students to and from the gymnasium, locker rooms, and other related service areas. Traffic planning should also include provision for the controlled movement of spectators. When there are balconies as well as seating on the main floor, each balcony should have separate entrances.

All traffic arrangements for spectators should provide direct movement to and from bleachers with a minimum of walking on gymnasium floors. Spectators should have access to drinking fountains, refreshment counters, and toilets without crossing the gymnasium floor. Steep, high stairways should be avoided. Ramps with nonslip surfaces might be substituted in appropriate places. Local and state building codes and standards of the National Fire Protection Association should be consulted.

FOYERS

Where finances and space will allow, foyers should be placed so they will serve as entries to gymnasiums and will guide spectators as directly as possible to seating areas. Building codes and the spectator capacity of the gymnasium will have a bearing on the size of the foyer. Toilet facilities for men and women, ticket-sales windows, ticket-collection arrangements, checkrooms, public telephones, a refreshment-dispensing room with counter, and lockable display cases should be provided, opening directly to the foyer. In some gymnasiums, these services might be omitted or reduced.

Floors should be of a type that will withstand heavy traffic and some moisture. It is appropriate to create a pleasing appearance in foyers through the use of special building materials, colors, lighting, and other means.

LECTURE ROOM

The lecture room provides opportunity for rainy-day conferences, chalkboard drills, movies, and so on. It may serve as a lounge for lettermen, a social center for teams after a game, and other similar uses. However, if the cost of construction prohibits proper sizes for other rooms, such as dressing, shower, training, and toweling rooms, then the lecture room should be sacrificed first.

MAINTENANCE-EQUIPMENT STORAGE ROOM

The size of this room will depend upon the amount and type of equipment to be stored. The usual equipment includes lawn mowers, a roller, wheelbarrows, hose, and the like. Space for a work-and-repair center is recommended. This area should be at ground level with double or garage doors.

SPECTATOR REST ROOMS

All athletic events that attract large crowds require rest-room facilities. Rest rooms should be designed for proper light, ventilation, and sanitary care. The size should be determined by the number of spectators at athletic events. Spectator rest rooms can be located in the field house unless the number of spectators requires more and dispersed locations.

CONCESSIONS

Concessions have come to be considered a necessary service for public gatherings. Appropriate space and distribution as well as adequate fixtures for concession stands within the field should be planned. Since plumbing and electrical services are already available in the field house, the concession stand might be located as a part of or adjacent to the field house.

OTHER FACTORS

Provisions should be made for the installation of electric scoreboards, a central sound and public address system, picture projectors, a radio, television, high-fidelity equipment, and cleaning machines. Special consideration should be given to floor outlets for scoreboards and public address systems so that they are placed according to the location of the scoring table. Wall outlets should be installed near cupped eyes to permit special lighting as needed. Controls for gymnasium lighting should be conveniently located, recessed, and keyed.

Drinking fountains and cuspidors should be accessible without causing a traffic or safety problem. It may be desirable to provide a drained catch-basin, grilled flush with the floor, to care for splash and overflow. Drinking fountains may also be located adjacent to the entrance of the gymnasium or in the foyer.

Cupped eyes should be installed in all walls at approximately a 15-foot height and 10-foot intervals for decorating convenience. They may also be used for attaching nets and other equipment to walls at appropriate heights. Bulletin boards and chalkboards should be provided in places where needed. If wall space is available, such boards may be provided for each teaching station in the gymnasium.

PROGRAMMING FOR CONSTRUCTION OF A GYMNASIUM (SAMPLE)

1. *Use of Gymnasium.* The area should be planned for instruction of classes, intramurals, and varsity sport practice. Some seating for spectators at contests would be desirable.
2. *Size.* The area for a junior high school gymnasium should be a rectangle measuring approximately 100 by 70 feet, providing 7,000 feet of space. In addition, there should be a storage area of 800 to 1,200 square feet. If the total area is to be used for two teaching stations, it should be divided by a soundproof partition and all space above the partition should be enclosed.
3. *Ceiling.* The ceiling should be acoustic, 21 feet to the lower side of beams or supports, with fixtures attached to the beams to support hanging equipment.
4. *Walls.* Walls should be of concrete block, smooth (no obstructions), and solid so that targets may be painted on walls for drills for throwing and kicking.
5. *Floors.* Floors should be #1 hard maple, placed over suitable base, and finished with a seal especially made for gymnasiums. The plan for marking lines on the floor should be drawn before the final sealing.
6. *Lighting.* Fluorescent lighting should supply 40 to 50 footcandles on the floor, and a switch should be installed at each door. Light fixtures should be guarded to prevent breakage. Additional lighting should be provided (controlled from switch in the equipment room) if instant playback equipment is to be used.
7. *Windows.* Windows should be placed on only one side of the room, to provide natural light. They should be covered with a protective screen to prevent breakage. Window sills should be six feet above the floor.
8. *Electrical Outlets.* Outlets should be installed on each wall, each a double-service unit.
9. *Equipment Storage Area.* At least 600 to 800 square feet should be provided for storage. If the gymnasium is to be used for two teaching stations, a 600-foot storage area should be placed on each side of the dividing door. Cabinets and shelves should be installed. The equipment room should have a double door, so that wide equipment may be stored and moved in and out easily. A telephone for emergency use should be placed in the equipment room.
10. *Mirrors.* Three full-length mirrors should be placed at one end of a wall, side by side, for visual analysis of movement.
11. *Bulletin Board.* Cork board should be hung on the wall near the entrance for posting materials and schedules.
12. *Drinking Fountain.* One should be placed on a wall in the corridor just outside the door to the gymnasium.
13. *Speakers.* Two matched speakers should be placed high on the wall or in the ceiling. Jack plugs should be installed on each wall to use for speaker input from the appropriate units.
14. *Paint.* Walls should be painted off-white or a very pale color.
15. *Other Items.* If the building is equipped with closed-circuit TV, two outlets should be provided for receiver. There should be a separate entrance for recreational use. The teaching station should be isolated from other parts of the building for evening functions.
16. *Implementation.* The programming of the facilities should be presented to the architect by the staff or a committee of the staff. The specifications should be discussed and clarified with the architect. The committee should provide any supplementary information requested by the architect.

Other Indoor Facilities

Some activities require specialized equipment and areas that may be provided in a main or auxiliary gymnasium. Even with careful planning, it is difficult to make adequate provisions without some compromise. In some activities, such as aquatics or riflery, the very nature of the activity necessitates a separate facility for the sport. The natatorium is considered in a later chapter. Bowling lanes have been provided in a number of public and private schools, most commonly in boarding schools. These facilities have also been provided in schools located in small communities where the school is the center of social and recreational affairs. Planners should consult the manufacturers of bowling equipment if bowling lanes are considered. Some other specialized needs that planners should consider are discussed in this section. The chapter on facilities for colleges and universities describes specialized facilities that may also be appropriate for secondary schools (see Part Two, Chapter 3).

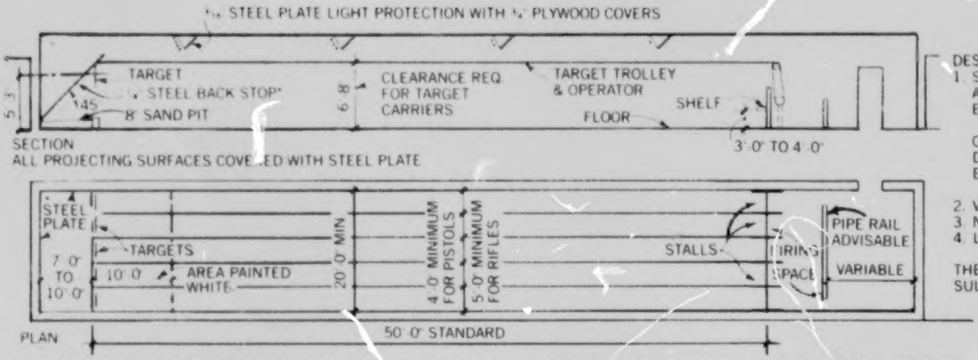
THE AUXILIARY GYMNASIUM

A multipurpose auxiliary gymnasium can be designed to supplement the gymnasium by accommodating such activities as badminton, fencing, fundamental skills, calisthenics, gymnastics, tumbling, wrestling, dance, volleyball, and one-wall handball, whether instructional or recreational. This facility provides flexibility in programming and can be used during inclement weather by classes scheduled for outdoors. Each school must determine the general use of the unit and select dimensions adequate to serve its needs.

An auxiliary gymnasium of 75 by 90 feet will house two volleyball courts, three badminton courts, three one-wall handball courts, two half-court tennis areas using adjacent walls, and other courts and areas. In addition, this unit can serve a variety of other activities in the intramural, recreational, or interscholastic program, which cannot all be accommodated after school in the main gymnasium. Some auxiliary gymnasiums are large enough to be divided into two teaching stations for certain activities. Special considerations or charactertistics of this facility, such as those relating to floors, walls, ceilings, and lighting, are similar to those in the gymnasium.

FACILITIES FOR GYMNASTICS AND TUMBLING

Two areas are imperative for gymnastics—one for storage and one for actual participation. Horses, rings, mats, ropes, bucks, springboards, bars, ladders, and trampolines are some of the items of equipment that will require floor and storage space. For participation in competitive tumbling, a floor space of at least 70 feet in one direction is required to house the five-by-60-foot mat. Instructional tumbling does not re-



DESIGN PROBLEMS
1. SAFETY
   A. TRAP SAFETY
   B. FIRING LINE SAFETY-USE STALLS
   C. SPECTATOR SAFETY
   D. RICOCHET PROTECTION
   E. SAFETY FROM SPILLED POWDER EXPLOSION
2. VENTILATION
3. NOISE
4. LIGHTING

THE USE OF RANGE DESIGN CONSULTANTS IS ADVISABLE

*"MULTI BAFFLE" & "ESCALATOR" TYPE BULLET TRAPS AVAILABLE & LESS HAZARDOUS THAN PLATE & PIT TYPE SHOWN NO SCALE

Figure 1. Indoor Regulation Rifle and Pistol Range.

quire as long a mat, but about 75 square feet of space per student is desirable. The space and mats can also be used for instructional wrestling.

Rings, Ropes, and Bars

Climbing ropes are attached to a height of 24 feet and drop to about three feet above the floor. Apparatus may be attached to the exposed beams. If the ceiling is placed below the structural members, the location of suspended equipment should be planned and eyebolts provided during the construction of the gymnasium. Ropes should be placed five feet apart, allowing one for each five students in class. Flying and still rings are attached at a height of 18 feet, are spaced 18 inches apart, and are suspended to a point 92 inches above the floor. Side walls should be a minimum of five feet away from the rings. End walls at least 35 feet from the point of attachment will afford safety for the participants. Traveling rings are supported from a height of 18 to 26 feet and are located seven feet apart along a continuous line. Lines should be provided for drawing ropes and rings not in use to the overhead, so as not to interfere with other activities.

High bars require both floor and wall or ceiling attachments, which should be considered in planning. Adjustable bars for class instruction can be arranged in a linear series. Bars vary from six to seven feet in length and require 12 feet of unobstructed space extending perpendicular to their long axis. Bars for interscholastic competition are most commonly located as individual units.

Equipment Storage

By planning in detail the equipment layout for gymnastics, attachment hardware for floors, walls, and ceilings can be included in the original design and construction. The manufacturers of gymnastic equipment will supply details for the attachment of their products. Preplanning results not only in proper installation but also in savings on the cost of doing the work at a later date.

Equipment not permanently attached will require storage space, unless the teaching station is limited to gymnastics. An adjoining storage room with double doors and flush threshold is recommended. The space required will depend on the amount of apparatus. In many instances, mats can be stored on wall hangers. The competitive-tumbling mat, which is 5 by 60 feet, should be rolled for storage and will require about 30 square feet of space.

RIFLE RANGE

Courses in firearm safety are becoming increasingly popular. Interest in recreational or competitive target shooting indicates the possible justification of a rifle range. The National Rifle Association provides details for constructing firing ranges. The information that follows will assist planners in determining general space requirements for a range.

Targets are located from 54 to 66 inches apart and are placed 50 feet from the firing line. From three to eight feet of space is required behind the targets for bullet-trap construction, and at least 12 feet should be provided behind the firing line. A ceiling height of eight feet is recommended. The width of the range will depend upon the number of firing points. The minimum width recommended for each point is four feet. A teaching station range should provide one firing point for every three students. Pulley devices should be used to place targets in the firing position and for returning them to the firing line. If rifles and supplies are to be stored in the range, and if rifle maintenance and repair are to be done in the range, additional space should be provided. For participant comfort and sound isolation, careful consideration should be given to ventilation and acoustics. The proper illumination of targets should also be provided. (See Figure 1.)

In schools where it is not possible to provide a range, a program can be administered in a gymnasium with portable bullet traps. Information can be secured from the National Rifle Association.

FACILITIES FOR DANCE

Limited Facilities in the Secondary School

Few secondary schools have specialized facilities for dance. One reason is that there has not been adequate emphasis on dance in the secondary school curriculum. There is some indication, however, that specialized concentrations (dance, sports, aquatics, gymnastics) in teacher preparation as well as cultural emphasis upon the arts is beginning to alter this pattern, particularly in suburban areas and in certain consolidated school districts. As these programs begin to establish their value, obtaining facilities will be easier. For those secondary schools that have a specialty in the performing arts or that are fortunate to be able to afford specialized dance facilities, adaptation of the specifications for college dance facilities is advised (see Part Two, Chapter 2).

Meanwhile, most secondary schools can use the standard gymnasium. The teacher who is interested in providing experiences for the students can plan curricular units, secure a few portable barres, borrow a record player and/or tape recorder from the audiovisual supply room, find storage area for a few percussion instruments, and secure space for a costume closet. The floor with the usual gymnasium seal on it is not ideal, but it can be used. The battle for time allotments and space assignment is perennial. Interest and effort can perform wonders.

A minimum dance facility will provide 100 square feet per student, one dimension to exceed 60 feet; full-length mirrors at a corner for analysis of skill from two directions; a speaker system designed to distribute sound evenly throughout the room; a control system for record players and microphones; and practice barres on one wall at heights of 34 inches and 42 inches. "For modern dance, the floor should be of hard northern maple which has been sealed and then buffed with fine abrasive."* Poor floors, in either class or stage areas, are better covered with a square of battleship linoleum than with a ground cloth.

As in the case of the elementary school, physical education equipment such as balls, ropes, and gymnastic apparatus can be used. Stall bars, if available, are an excellent substitute for ballet barres as well as a fine medium for creative activity. By wise planning, basic equipment (recordings, percussion instruments, and portable lighting boards) can be floated from school to school for production use.

Portable percussion racks made in an industrial arts department solve the problems of easy storage and efficient class and program use. Portable mirrors, six feet tall and eight feet wide, can be mounted 18 inches from the floor on rollers and moved into the dance area, if wall-mounted mirrors are not feasible. Portable ballet barres of lightweight aluminum are desirable when unobstructed wall space is at a premium.

Adaptive rooms, gymnastic rooms, weight-control rooms, or recreational game rooms may have spaces available for dance. Careful preplanning of new facilities suggests the possibility of combining two or more of these.

Two community resources are feasible—churches and local theater groups. Churches are now interested in dance and may permit temporary or permanent use of a large classroom or a church auditorium. Community theater groups are adding dance experiences for all age levels to their gamut of activities. It may be possible to arrange for use of their areas during the school day.

The possibility of pooled resources in the performing arts—dance, drama, music—opens wide potentials for developing excellent facilities, economy in their use by several departments, and rich experiences in multimedia.

Performing Area for Dance and Ballet (See Production Areas.) Part Two, Chapter 2, Dance

The stage should be situated at the end of the room farthest from audience entrances and should have separate entrance for the dancers. The stage can be formed by curtains or flats. A back curtain should have a center opening and be hung at least *three feet forward of the back wall to provide* crossover space for the performers. In the case of a raised stage, the front curtain should be set back about four feet from the raised edge to provide an apron (forestage). Side curtains or flats should be provided.

If curtains cannot be used, an open stage is advisable. The folding mats used in physical education can be set on edge to form entrances and exits. Flats and portable screens are alternative possibilities.

Performing Area for Folk and Social Dance

Roll-away bleachers can be installed at one end of the room. Provision should be made for storage of folding chairs, which can be placed along the side walls.

An auxiliary performing space can be a patio or other outdoor area, such as a dance green or a broad, level surface at the entrance to a school building, which can be adapted for occasional use for dance performances. A square area of battleship linoleum may be placed on the cement surface and taped down to protect the dancers' feet and legs. The covering comes in wide strips, which can be taped together and rolled and stored when not in use.

Traffic Safety Education Areas and Facilities

Our nation's schools—public, parochial, and private—are so structured as to be the logical and ideal environment in which to teach traffic safety education. The guidelines outlined below are in keeping with approved standards and national recommendations.

INDOOR FACILITIES

Ideally, there should be at least one classroom used exclusively for traffic safety education. A psychophysical laboratory with testing devices can be situated in the classroom. Schools using the multimedia system often combine the classroom, multimedia equipment, and psychophysical laboratory in the same room. The indoor program should also include a simulator laboratory, a resource center, and an office.

All classrooms and the office should be located as close as possible to one another and on the first floor of the building. In addition, the classrooms should be located near the area used to park the vehicles. This arrangement will allow minimum passing time from the classroom to the vehicles, better control of the students, and accessibility to the vehicles for their use in demonstrations (e.g., changing a flat tire).

Classroom

Classroom facilities should be planned to accommodate the projects and activities required of the students using the room. Frequently, the classroom is combined with the psychophysical laboratory. With this type of arrangement, a room size of 30 by 40 feet is recommended. Where separate rooms are used, the classroom should be of standard size.

The number of students permitted in the classroom should be determined by dividing the floor area by 20 square feet (e.g., a classroom measuring 30 by 40 feet would effectively handle 60 students). When the number of students in a classroom exceeds 50, two exits should be provided.

The following features of the classroom should also be considered when determining size and location:

- Space for testing and small-group discussions

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*American Association for Health, Physical Education and Recreation. *Dance Facilities*. Washington, D.C. The Association, 1972 pp. 20-21.

- Table-top cabinets for storing and displaying testing equipment and demonstration models
- Facilities for display of loose charts and maps
- Permanent picture screen and adequate electrical outlets.

Suitable color combinations and durable equipment can enhance the morale of the classroom's occupants, resulting in a better learning atmosphere. Part Two, Chapter 7, will be helpful when planning the necessary lighting requirements and electrical outlets.

Desk tops and other furniture occupy large portions of the visual field. Light-finished birch, maple, or nonglossy laminated plastics are desirable since they usually fall within the proper range of reflectance. Desk tops must be nonglossy to avoid distracting reflections from windows and overhead light sources. Chalkboards should be light enough to blend well with the background and dark enough to provide sufficient contrast to chalk writing.

Movable furniture allows flexible arrangements for small-group discussions or committees, but this type of equipment quite often produces a disorderly and noisy classroom. Permanent furniture usually lasts longer, is more orderly, and reduces the amount of unproductive noise. However, this arrangement reduces the number of activities that can take place in a room. Before deciding on the type of furniture, the instructor must determine the objectives of the program and the kinds of activities that will take place in the classroom. If movable chairs are selected, they should be of a wide-base design to eliminate the possibility of an upset when moved or sat upon.

Other than the instructional material, such as flannel and magnetic boards, models, and cutaways, the room should be equipped with fire-resistant shades that can substantially darken the room. Also, the installation of a dimmer switch (rheostat) for the lights will be very useful. Instructional material with the following characteristics should be selected:

- Attractive in design, color, and format
- Relevant and basic to program objectives
- Appropriate for students' maturity-level needs and interests
- Up-to-date and in agreement with current educational practice
- Positive rather than negative in approach
- Free of objectionable commercialism.

Psychophysical Laboratory

The psychophysical laboratory contains equipment needed to test the student's physical, mental, and emotional qualifications required for safe and skillful driving. When not combined with the classroom, the laboratory should be at least 21 by 30 feet.

The equipment will essentially be of the same color and design as that used in the classroom. The required furniture and equipment will include a demonstration table, chairs, work tables, and spaces to accommodate equipment for testing visual acuity, depth perception, color vision, field of vision, reaction time, steadiness, night vision, and the like.

Care should be taken when arranging the equipment for visual testing so that light sources will not affect the results. The brake-reaction test should be so placed that both student and testing device are secure. (see figure 2).

Multimedia Laboratory

In practically all schools, the multimedia laboratory is the classroom. The multimedia method uses motion pictures, slides, and dual-track sounds intermittently to as many as 60 students at a time.

The size of the laboratory should be based upon the same criteria as that of a conventional classroom and upon whether the psychophysical laboratory is to occupy the same room. Figures 2 and 3 can be used as guidelines for the layout of the multimedia laboratory. The one correction required of Figure 2 will be in the selection of the furniture.

Wires must be run from the main component of the system, the classroom communicator, to each student's station. At each station a student responder should be recessed into the desk or table, to eliminate the possibility both of dropping the responder and of neighboring students seeing their classmates' responses. This design makes the use of permanently installed desks or tables desirable. (See figure 3.)

There should be no more than 10 student stations per row. This arrangement will correspond with the number of student recorders located on the teacher's console (classroom communicator.) Ideally, the wires to each station should be under the floor. A false floor could be constructed to meet this requirement. Wires leading from the floor to each station should be attached to or under the tables, to eliminate the possibility of tripping. The depth of the writing area of the desk should be at least 18 inches.

*The chairs should be movable and have wide bases. This style of chair allows for easy egress from the rows and aids when cleaning the floor.

The multimedia system will require the following equipment:

- Screen, permanently installed or pull-down model
- 16mm sound projector, adaptable to wide screen and conventional films
- Individual student responder.

The following optional equipment should also be considered:

- Programer—allows the instructor to develop his own audiovisual teaching material
- Printer—prints a permanent record of each student's response.

Simulator Laboratory

Driver education simulators are accepted as a means of providing the preliminary steps to behind-the-wheel instruction. The driving simulator method of instruction assists the student in learning to (a) identify key segments of the traffic environment, (b) predict the action of others, (c) decide the best response for the situation, and (d) execute this decision in properly timed actions.

Because of the nature of the simulator units, facilities for them should be considered as permanent installations, preferably in a separate classroom. However, occasionally such conditions as lack of space or financial problems may best be met with either trailer-type mobile classrooms or a self-propelled bus with simulator units installed.

The following factors should be considered when deciding on the number of units and classroom size:

- Number of students who will be using the units in one year

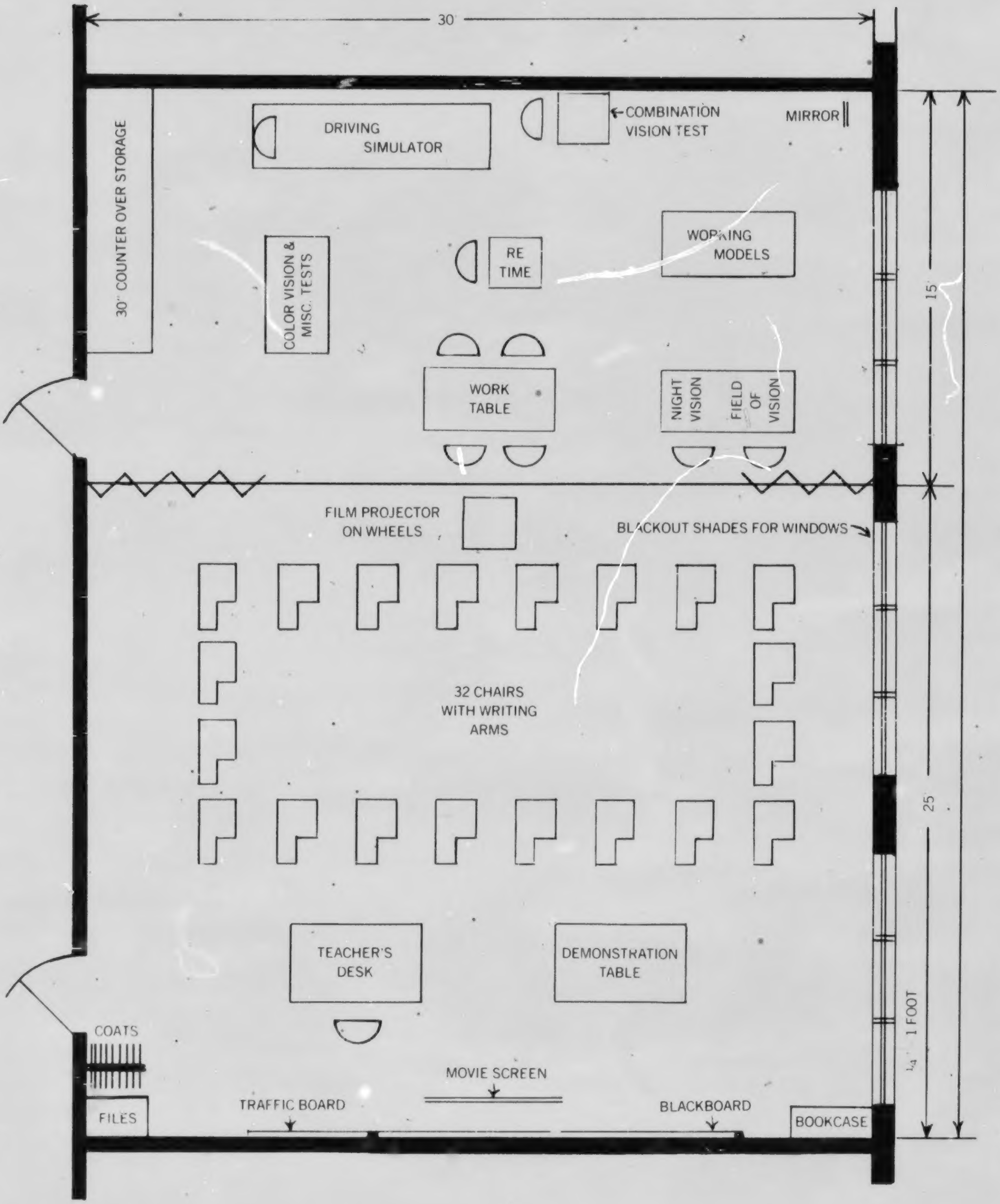
30'
30" COUNTER OVER STORAGE
DRIVING SIMULATOR
COMBINATION VISION TEST
MIRROR
WORKING MODELS
COLOR VISION & MISC. TESTS
RE TIME
15'
WORK TABLE
NIGHT VISION
FIELD OF VISION
FILM PROJECTOR ON WHEELS
BLACKOUT SHADES FOR WINDOWS
32 CHAIRS WITH WRITING ARMS
25'
TEACHER'S DESK
DEMONSTRATION TABLE
1/4" 1 FOOT
COATS
MOVIE SCREEN
TRAFFIC BOARD
BLACKBOARD
FILES
BOOKCASE

Figure 2. Driver Education Classroom and Laboratory.

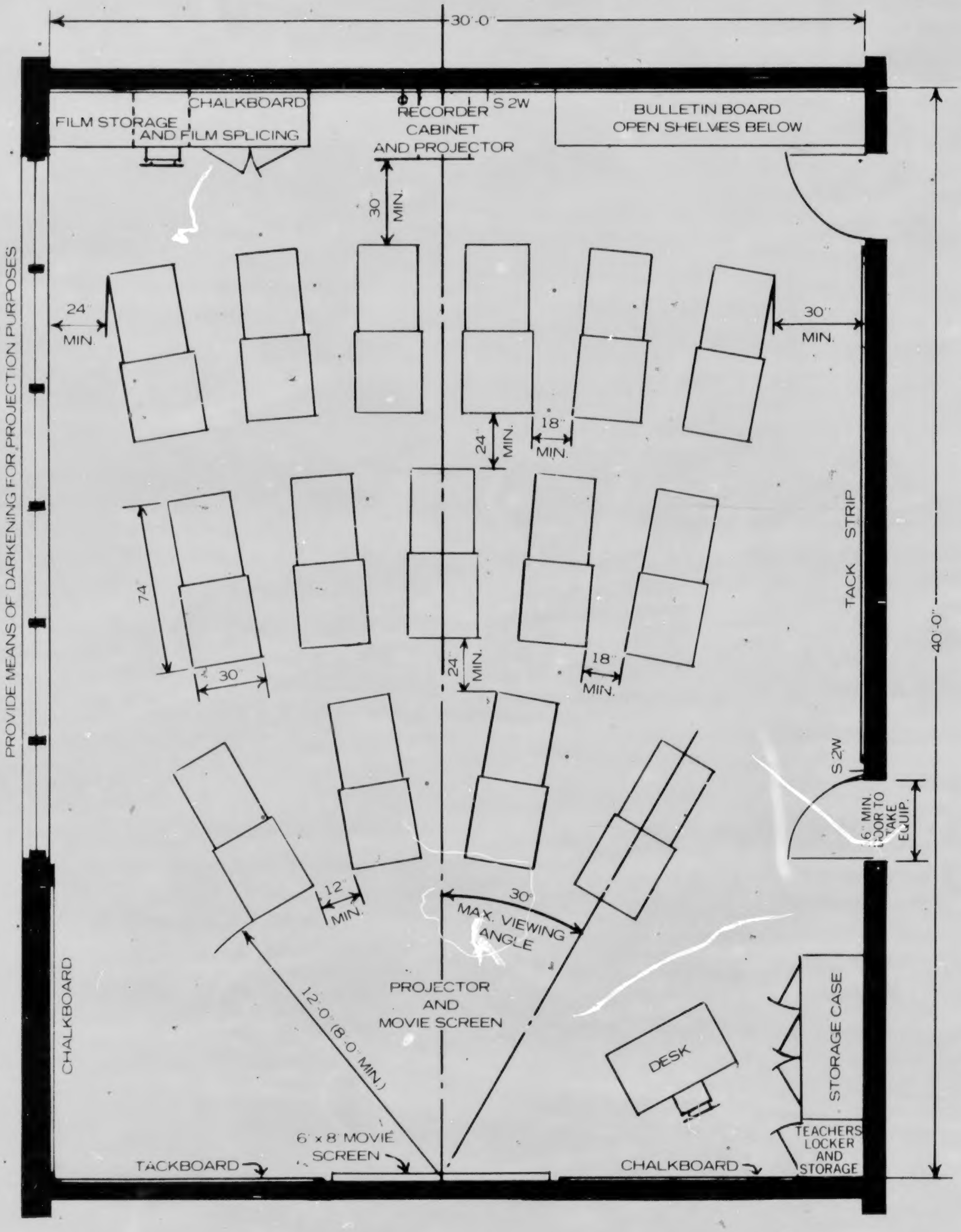
30'-0"
FILM STORAGE
CHALKBOARD
AND FILM SPLICING
RECORDER
CABINET
AND PROJECTOR
S 2W
BULLETIN BOARD
OPEN SHELVES BELOW
30" MIN.
24" MIN.
30" MIN.
18" MIN.
24" MIN.
74"
30"
24" MIN.
18" MIN.
12" MIN.
PROVIDE MEANS OF DARKENING FOR PROJECTION PURPOSES
TACK STRIP
40'-0"
S 2W
36" MIN. DOOR TO TAKE EQUIP.
30° MAX. VIEWING ANGLE
12'-0" (8'-0" MIN.)
PROJECTOR AND MOVIE SCREEN
CHALKBOARD
STORAGE CASE
DESK
TEACHERS LOCKER AND STORAGE
6' x 8' MOVIE SCREEN
TACKBOARD
CHALKBOARD

Figure 3. Typical 15-Car Drivotrainer Classroom.

- Number of hours of simulation instruction to be given per student (the number of hours of simulation instruction that may substitute for in-car instruction differs from state to state)
- The possibility of sharing simulator equipment with other schools
- Future enrollment.

The most commonly used installations are 16-, 12-, and 8-place units. The suggested minimum size for an 8-unit laboratory is 24 by 38 feet, while 16-place systems require a minimum of 28 by 44 feet. Decisions to use rooms of smaller dimensions or different proportions should be made only with the help of an experienced simulator laboratory designer.

The room should be clear of obstructions that might interfere with the projector beam, and should be provided with the regular complement of chalkboard, bulletin board, tackboard, magnetic board, booster cushions, pedal extenders, and key board for unit ignition keys

The simulators should be arranged in a semicircular pattern. The viewing angle of the outside unit in each row should not exceed 30 degrees (Figure 3), with the first row located no closer to the screen than the width of the projected image.

The complete image on the screen must be seen by all students sitting at the controls in a normal manner. Consequently, the first row of units may be placed on the original floor, but each succeeding row of units should be placed on risers of four to six inches. A minimum of 24 inches should be allowed between the rows. Aisle spaces must comply with state safety codes. The projector should be located in the center and at the rear of the room.

A normal classroom would permit a screen up to 15 feet wide. A screen this large, however, would require the first row of units to be placed no closer than 15 feet away. With this arrangement, the front part of the room may accommodate armchair desks, which could be used for discussions with chalkboard, flannelboard, or cutaways (Figure 3).

It should be possible to control the lighting from at least two locations in the room. Both locations should have a rheostat and be so situated as to allow the teacher to observe the students yet not interfere with the projected image. One switch should be located within an arm's reach of the projector at the center-rear of the room.

Electrical outlets should accommodate three-prong Humbbel plugs. It is important that an adequate electrical power supply be available, since any fluctuations will result in irregularities in the system's scoring components. The simulator system will require 120 volt, 60 cycle, 15 amp service.

The simulator laboratory should be air-conditioned to allow for temperature and humidity control, since both of these conditions can affect the efficiency and life of the recorder.

When a mobile trailer or self-propelled bus is used for simulator facilities, the simulator manufacturers should be consulted to provide specific information concerning costs, space, arrangement requirements, and other details. As with the classroom units, it is important that the power supply not be erratic. Adequate power can be supplied through 220 volt, 100 amp electrical service.

A mobile unit requires a flat concrete or asphalt area near the school building. If the unit is placed on an asphalt surface and final leveling accomplished with leveling jacks, planking should be placed under the jacks so they will not cut into the surface during hot weather. If the unit is located close to the school building, students will not have to be provided with an area to hang their clothes inside the trailer or bus. Proximity to the school building will also aid in keeping the trailers clean. Lighting and a security fence to deter vandalism should also be considered.

OUTDOOR AREAS AND FACILITIES

Because outdoor facilities for traffic safety education are best located adjacent to the indoor facilities, planners should consider both areas at the same time.

Driving Area

Behind-the-wheel instruction can be given outdoors to six or more students simultaneously by one instructor. Because the instructor is located outside the vehicles, emphasis is placed on learning rather than teaching. Students can experience common and emergency driving situations under controlled conditions.

Prior to and during the 1960's, multiple-car driving ranges were constructed as facilities for learning basic skills. Recently, such facilities have been revised to include more decision-producing "traffic mix" situations. Space that was previously used for "X" exercises is now being used for maneuvers that develop perception and merging. The modified "Y" has been reported by Laurence Quane as being equally suitable to develop the skills previously acquired on the "X" and "T" exercises. Dimensions of the driving range should be a minimum of 200 x 100 feet. Also, advanced driving maneuvers such as those conducted at the National Safety Council's winter driving workshops can be taught safely on some driving ranges.

With three types of facilities to choose from (basic skills, traffic mix, advanced driver training), careful consideration must be given to the program's instructional objectives before decisions are made on size and layout. If the simulation method is to be used in the program, the basic-skills range would be the best selection. The rationale for this selection would be that simulation is designed to develop proper perceptual, judgmental, and decision-making capabilities relative to the driving task, whereas the range portion of the program would concentrate on the manipulative skills. Conversely, if the range program is designed to supplement the on-the-street phase, then the best facility would be the traffic-mix range.

Ultimately, the cost of the facility may well be the deciding factor. The major expenditures will be for land acquisition, construction, and operating costs. The number of students to be enrolled in the program may or may not warrant the expenditures required to build a range. If present or future student enrollment is estimated to be less than 250, the range should be a dual-use facility (i.e., parking lot) or the cost may be prohibitive. If the number of students to enroll in the program each year exceeds 250, a single-purpose range can be financially justified.

A few schools are successfully using school parking lots with dimensions ranging from 105 by 170 feet to 160 by 360 feet. Dimensions less than 200 by 100 feet dictate that the range be used as a basic-skills facility. If a traffic-mix range is desired, it should be remembered that the larger the facility the greater the opportunity for traffic mix. The traffic-mix facility should be at least 200 by 100 feet. The advanced

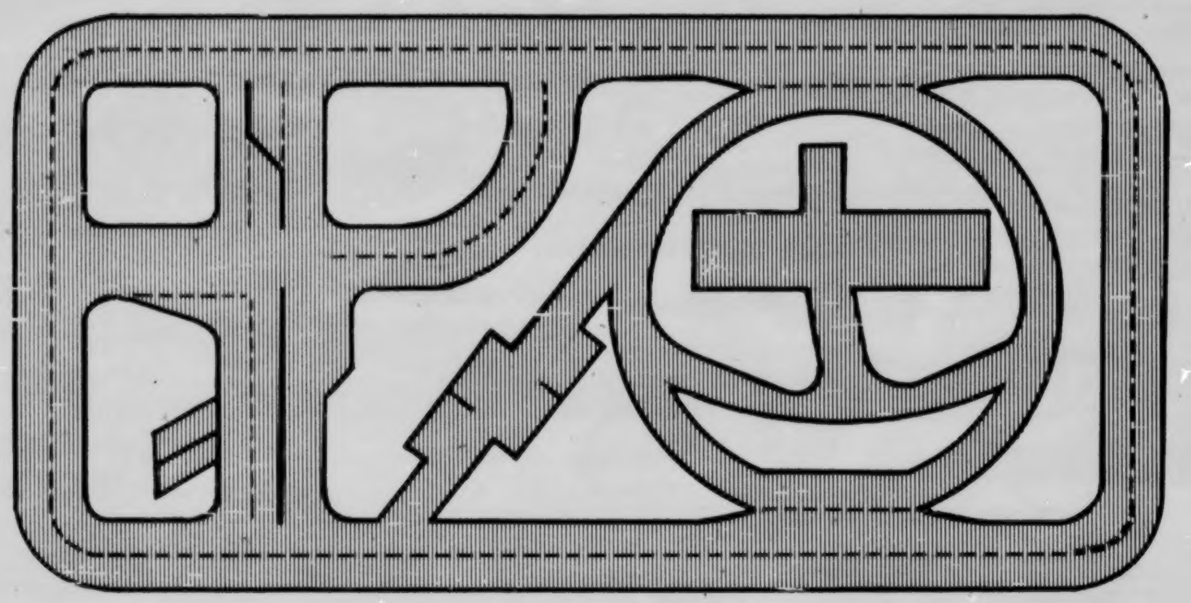

Figure 4. **Illinois State University Multiple-Car Facility, Normal, Illinois. Minimum Fundamental Dimensions, 4″ Line Width, 18″ R for Intersections, 12′ R for Other Corners, 12′ Lanes.**

driver training facility must be larger than 200 by 400 feet because of the speeds attained. The staff at the General Motors Proving Grounds have recommended that the skid pan area should have dimensions of at least 24 by 200 feet.

The following factors should be considered when deciding on the size of the facility:

- Visual contact must be possible from one point to all other points (some ranges have used a tower to accomplish this requirement).
- There should be provisions for practicing a variety of driving situations.
- The traffic-flow pattern should allow a number of vehicles to operate simultaneously, each executing a different maneuver without interfering with other vehicles.

The facility should be constructed of asphalt or cement, with movable curbing to allow for ease of snow removal and use of the facility for other purposes. Movable curbing also makes it easy to change the course layout.

If an off-road recovery area is planned, the drop-off edge should be constructed of cement. If asphalt is used, it may crumble and/or become rutted in hot weather. The drop-off should be from three to four inches high and 250 feet long. A 12-foot lane should be provided for a return. These dimensions will allow the off-road recovery maneuver to be run at speeds of 30 mph.

Equipment

The following equipment should be considered in planning the basic facility:

- Curbing, preferably in six-foot movable lengths
- Portable new international traffic signs (e.g., Stop; Yield; No Passing; No Left, Right, or U Turns; Speed Limit; and One Way)
- Bases for traffic signs and flags
- An operational traffic light
- Traffic cones (rubber and preferably 12 inches or less in height—more durable than plastic, especially in cold weather, and will not mark up the vehicles as much as the taller ones)
- Roll-down tape or paint for lane markings (new color coding for lane distinctions)
- Barricades (movable curbing can be used)
- Communications equipment
- Water source for cleaning range and wetting skid area.

The following features should be considered for inclusion in the facility.

- Curves
- Intersections, including one or more "T" intersections
- Two-, three-, and four-lane streets
- One-way street
- Traffic circle
- Parallel and diagonal parking areas
- No-passing zone
- Crosswalks and stop lines
- Raised hill, 5-percent grade
- "T", "X", and "Y" exercise areas (unless a modified "Y" area is to be used)
- Figure 8 exercise area
- Area for merge and exit techniques.

The following equipment should be considered for vehicles:

- One or two manual-transmission vehicles
- Instructor's mirrors
- Dual brakes in all vehicles (vehicles may be used in the on-the-street phase of the program at some time)
- Decals, bumper signs, car numbers
- Communication receivers.

The following special equipment should be considered for advanced maneuvers:

- Blowout simulator and air storage tank—air compressor can be installed in trunk
- Rear wheels lock-up device to induce skids.

The following equipment is recommended for all vehicles:

- Heavy-duty suspension
- Disc brakes and wheels
- High-performance power train
- Heavy-duty transmission
- Axle ratio of 3.12 to 1
- Heavy-duty generator.

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FACILITIES for COLLEGES and UNIVERSITIES

GUIDELINES FOR COLLEGE AND UNIVERSITY FACILITIES

The colleges and universities of the United States are facing complex problems of economics, enrollment, and planning. The magnitude of these problems has made the development of a master plan essential to college and university development. Space requirements of various programs of the institutions of higher learning have caused those responsible for master-plan development to request standards for facilities in terms of square feet per student. Standards in these terms are meaningful to campus planners, since relating standards to predicted enrollment results in assured space for all disciplines involved.

The following standards are recommended for consideration by those involved in planning college and university facilities for physical education, intramural sports, intercollegiate athletics, and recreation. It has been estimated by intramural leaders that the extent of participation in physical recreation by graduate students is 25 percent of that of undergraduates. Consequently, it is suggested that planners add 25 percent of the graduate enrollment when computing space needs for recreational areas.

TYPE "A"—Indoor Teaching Stations

Space requirements: 8.5 to 9.5 square feet per student (total undergraduate enrollment).

Includes: Gym floors, mat areas, swimming pools, courts, and the like (adjacent to lockers and showers and within 10-minute walking distance of academic classrooms).

Uses: Physical education class instruction, varsity sports, intramural sports, unorganized informal sports participation, student and faculty recreation, and similar activities.

Breakdown of Type "A" Space:

A1—Large gymnasium areas with relatively high ceilings (minimum 22 feet) for basketball, badminton, gymnastics, apparatus, volleyball, and the like (approximately 55 percent of Type "A" space).

A2—Activity areas with relatively low ceilings (minimum 12 feet) for combatives, therapeutic exercises, dancing, weight-lifting, and the like (approximately 30 percent of Type "A" space).

A3—Swimming and diving pools (approximately 15 percent of Type "A" space).

TYPE "B"—Outdoor Teaching Stations

Space requirements: 70 to 90 square feet per student (total undergraduate enrollment).

Facilities: Sports fields of all types (adjacent to lockers and showers and within 10-minute walking distance of academic classrooms).

Uses: Physical education class instruction, varsity sports, intramural sports participation, student and faculty recreation, and similar activities.

Breakdown of Type "B" Space:

B1—Sodded or turfed areas for soccer, touch football, softball, and the like (approximately 60 percent of Type "B" space).

B2—Court areas for tennis, volleyball, flicker ball, and the like (approximately 15 percent of Type "B" space).

B3—Specialized athletic areas for track and field, baseball, archery, varsity football, golf, camping demonstrations, and the like (approximately 25 percent of Type "B" space).

B4—Swimming pools (included in B3 approximation).

TYPE "C"—Sports Fields and Buildings, Intramural, and General Outdoor Recreation Areas

Space requirements: 120 to 140 square feet per student (total undergraduate enrollment).

Facilities: Playing fields and athletic buildings of all types; softball diamonds, tennis courts, arenas, field houses, and so on (too far removed from general student lockers, showers, living quarters, and academic buildings for use as teaching stations; one-mile maximum distance from major residence areas).

Uses: Intramural sports, varsity sports, unorganized informal sports.

Breakdown of Type "C" Space:

C1—Sodded or turfed areas for soccer, touch football, softball, and the like (approximately 40 percent of Type "C" space).

C2—Court areas for tennis, volleyball, flicker ball, and the like (approximately 10 percent of Type "C" space).

C3—Specialized athletic areas for track and field, baseball, archery, varsity football, golf, camping demonstrations, and the like (approximately 15 percent of Type "C" space).

C4—Swimming pools (included in C3 approximation).

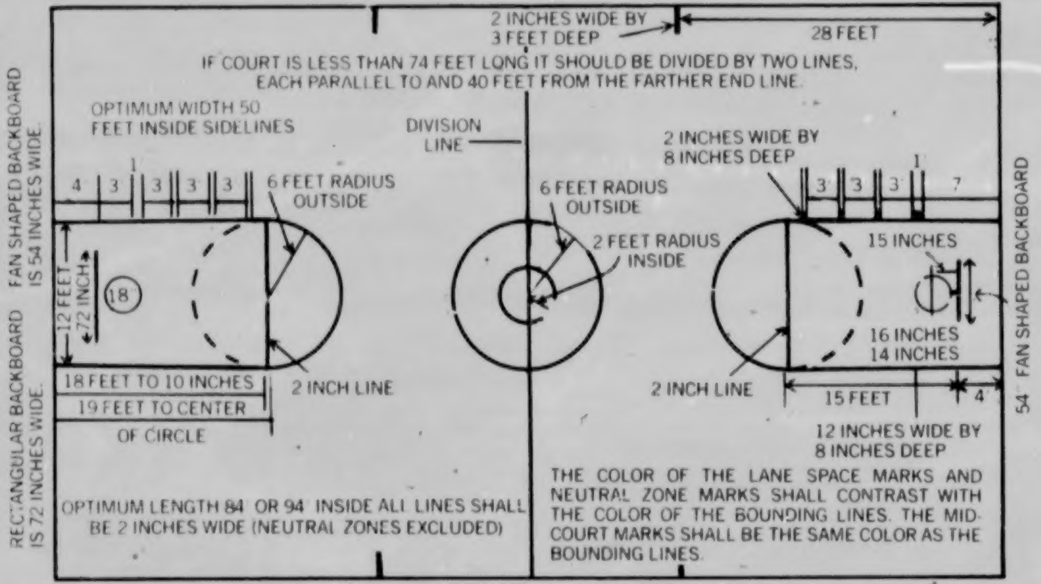
C5—Sports and intramural buildings providing lockers, showers, play space, office space, lounge rooms, and similar facilities (approximately 5 percent of Type "C" space).

TYPE "D"—Informal Recreation Areas

Space requirements: Included in C3.

Facilities: On-campus picnic areas, not more than one and one-half miles from residence areas (approximately 15 percent of total Type "C" space).

Uses: Picnics, outing activities (including outdoor cookery, evening songfests, storytelling, and similar programs).


2 INCHES WIDE BY
3 FEET DEEP
28 FEET
IF COURT IS LESS THAN 74 FEET LONG IT SHOULD BE DIVIDED BY TWO LINES, EACH PARALLEL TO AND 40 FEET FROM THE FARTHER END LINE.
FAN SHAPED BACKBOARD IS 54 INCHES WIDE.
RECTANGULAR BACKBOARD IS 72 INCHES WIDE.
OPTIMUM WIDTH 50 FEET INSIDE SIDELINES
DIVISION LINE
4
3
1
3
3
3
6 FEET RADIUS OUTSIDE
12 FEET
72 INCH
18
18 FEET TO 10 INCHES
19 FEET TO CENTER OF CIRCLE
2 INCH LINE
6 FEET RADIUS OUTSIDE
2 FEET RADIUS INSIDE
2 INCHES WIDE BY 8 INCHES DEEP
3
3
3
1
7
15 INCHES
16 INCHES
14 INCHES
2 INCH LINE
15 FEET
4
12 INCHES WIDE BY 8 INCHES DEEP
54" FAN SHAPED BACKBOARD
OPTIMUM LENGTH 84' OR 94' INSIDE ALL LINES SHALL BE 2 INCHES WIDE (NEUTRAL ZONES EXCLUDED)
THE COLOR OF THE LANE SPACE MARKS AND NEUTRAL ZONE MARKS SHALL CONTRAST WITH THE COLOR OF THE BOUNDING LINES. THE MID-COURT MARKS SHALL BE THE SAME COLOR AS THE BOUNDING LINES.

Left End Shows Large Backboard for College Games.

MINIMUM of 3 FEET
Preferably 10 feet of unobstructed space outside. If impossible to provide 3 feet, a narrow broken 1" line should be marked inside the court, parallel with and 3 feet inside the boundary.

SEMICIRCLE BROKEN LINES
For the broken line semicircle in the free throw lane, it is recommended there be 8 marks 16 inches long and 7 spaces 14 inches long.

Right End Shows Small Backboard for High School.

Figure 1. Basketball Court.

TYPE "E"—Off-Campus Outdoor Education, Camping, and Recreation Areas

Facilities: Outdoor camping and outdoor education center, off-campus golf course, university country club, and the like (25-mile maximum distance from heart of the campus).

Uses: Overnight camping, picnics, outing activities, camping demonstrations, golf, archery, boating, canoeing, outdoor swimming, formal classes taught outdoors.

Estimate of space need: It is difficult to state these needs on the basis of square feet per student. Such areas contribute materially to the outdoor education and recreation of both men and women students, but the many variables in climate, topography, distance from the heart of the campus, and emphasis on outdoor education mean that standards of space will also vary.

Ancillary Areas

Investigation indicates that a reasonable standard for determining the space needed for lockers, showers, toweling rooms, equipment storage, supply rooms, and offices associated with Type "A" space is a square footage equaling approximately 10 percent of the play or activity area in a gymnasium facility. As an example of how this figure may be used, assume that a building is being planned to provide 100,000 square feet of activity space. In other words, the square footage of the swimming pool surface and deck and of all gymnasium floors, including high and low ceiling areas, equals 100,000 square feet. The space needed for ancillary areas would be in the neighborhood of 10,000 square feet. Architects generally speak of the combination of play space and ancillary areas in a gymnasium as "net usable area." Consequently, the net area in the building would be approximately 110,000 square feet.

All other space in a building, including hallways, stairways, wall thicknesses, lobbies, public toilets, bleachers for public use, custodial space, and space needed for service conduits of all types, is spoken of by many architects as "tare." The space needed for tare varies greatly from building to building, depending upon the function and architectural design. A rough estimate of the area needed for this item is approximately 30 to 50 percent of the net area previously computed. By adding tare, ancillary, and net space, a rough estimate of the gross footage of a building plan can be computed. This figure is helpful in preliminary discussions of costs involved.

Enrollment Relationships.

When standards in terms of square feet per student are used as guides in college or university planning, it is natural to ask where the computation begins. At what point, from ten students up, do the standards become meaningful? Obviously, for a college of 200 students, nine square feet per student of indoor area for sports and athletics would be woefully inadequate. It would not even provide one basketball court.

A university or college meeting the space standards for 1,500 students represents the minimum physical recreation space needs of any collegiate institution. As a college or university increases in size, these standards are applicable regardless of enrollment.

Peak Load After School Hours

Study of utilization problems at the various universities has shown that the greatest load on facilities each day occurs between 1 and 10 p.m. In all of the universities studied, either one or two years of physical education was required of all students. As long as the requirement in basic physical education is not greater than two years, the greatest demand for space appears to come after the usual school hours. The situation may be different at universities that require all students to register for physical education each year they are in residence.

A few universities have dropped required physical education in the belief that this will reduce the pressure on facilities for sports and athletics. The futility of this move is obvious. In fact, the elimination of a physical education requirement may increase the demands for this type of space, since all students will then tend to use after-school hours to meet their physical activity needs. This concentration of student activity may make it necessary to provide greater play and exercise space than needed for a balanced program of basic instruction, free-play opportunities, and intramural-sports competition.

THE MAIN GYMNASIUM

The type and size of gymnasium facilities needed for a given college or university will depend upon many factors, one of the most important of which is the anticipated enrollment of the institution. A gymnasium building planned to serve 2,000 students will, obviously, be considerably smaller than, and different in design and construction from, a facility planned for a university of 10,000 or more students. In other words, planning must be done with future enrollment in mind and as part of the master plan for the college or university. If a college or university has a definite enrollment ceiling, the building may be planned for this enrollment. If the enrollment ceiling is indefinite, however, the structure should be planned so that additions to the buildings are feasible. Most universities or colleges should plan and build for expansion. Gymnasium space is usually planned to take care of enrollments for at least ten years. Universities of 15,000 or more students may find it desirable to build more than one gymnasium structure, each servicing an area of the campus.

Another factor that will affect the type of building constructed is the philosophy of the administration concerning athletics and physical education. Many questions need to be answered before planning begins:

- Will all students be required to take physical education for one, two, three, or four years?
- Is the required program in physical education to be broad in scope, i.e., will a great many opportunities to develop sport skills be extended to students?
- Is teacher education in physical education to be part of the program?
- What responsibility does the college or university take for the physical education, recreation, and fitness of its faculty?
- Is it likely that research in physical education, health, and recreation may be an important aspect of the program?
- What is the scope of the varsity athletic program? (The facility requirements are considerably different if varsity teams are to be fielded only in the major sports.)
- What will be done to provide facilities for an expanded program of intramurals and extramurals?

Principles of Planning and Construction

Indoor facilities for sports and athletics should be planned so that all activity areas will be available to both men and women. It is unwise to identify facilities as men's or women's athletic areas. Good planning will permit easy access to all areas from both the men's and women's locker rooms. This type of planning permits the flexibility necessary for efficient utilization and control.

The space used for permanent seating of spectators at athletic events should be kept to a minimum unless space and funds present no problem. Roll-away or folding bleachers should be used in order to use the available space efficiently. Most colleges and universities can neither afford to invest large sums of money nor give large areas of space to permanent seating that is used only a few times each year.

The health and safety of those using the building should be of prime consideration in the planning of all activity areas. The disabled and the aging should also be considered (see Part Two, Chapter 6).

The construction of the types of facilities and the allocation of adequate square footage to handle a broad athletic and intramural program will provide more than enough gross space for a two-year physical education requirement for all students.

The traffic patterns for a building should be carefully studied. Lockers, showers, and toweling rooms should be centrally located in the building so that they may serve all activity areas. Easy access should be provided from the locker rooms to the playing fields adjacent to the building (see Part Two, Chapter 5).

Storage rooms for equipment and supplies should be carefully planned and functionally located. These rooms should be of three types:

- Central receiving storage rooms, to which all equipment and supplies are delivered. The warehouse storage room should be accessible by truck.
- Utility storage rooms located adjacent to gymnasiums so that bulky equipment may be easily moved to the floor and back to storage. Overhead doors or double doors should be large enough to permit free movement of heavy equipment.
- Supply rooms with an attendant's window opening to the locker rooms.

Off-season storage rooms are critically needed. The type of equipment to be moved and stored will define the dimensions of the room and size of the doors needed. Reserve storage should also be provided.

Location

If physical education and athletic facilities are used by all of the students at a college or university, the gymnasium facility should be centrally located in order to be easily reached from both the academic buildings and student housing. Physical education facilities serving as teaching stations must be close enough to academic buildings to make it possible for students to move from the classroom into the gymnasium and back within the time provided between classes.

Buildings used only for intramural and intercollegiate activities may be located farther from classrooms and housing than a general-use gymnasium would be. This is especially true if the activities promoted in these buildings are scheduled. If the building is to be used for unscheduled participation of students, however, the amount of use will vary inversely with the distance from housing and other campus buildings.

Guidelines for Determining Needs

The criteria for determining the size of the gymnasium building are (a) the nature of the total physical education program, (b) student load as determined by enrollment and attendance requirements per week, (c) spectator interests, and (d) anticipated enrollment growth.

The physical education building should include one main gymnasium to be used for general physical education class work, intramurals, and intercollegiate athletic activities in basketball and wrestling. Ideally, the size of the floor for an enrollment of 1,000 students would be approximately 110 by 140 feet. (Use a rectangular dimension if the facility will be heavily used for spectator sports.) This size would provide for one official and three junior-size (35 by 81 feet) basketball courts, with adequate space between the courts and between the courts and walls. If desirable, folding partitions can be used to provide three practice gymnasiums, each 48 by 140 feet. For the basketball courts, backboards that swing up to the ceiling are needed, since nonfolding backboards would interfere with court usage for volleyball and badminton. In order to increase the number of other instructional units, electrically controlled wooden partitions should be installed.

If the gymnasium is to be used for intercollegiate athletics, seating must be provided for spectators (three square feet per person.) Portable folding bleachers, which can be easily moved, are recommended for seating. Portable knock-down bleachers are not recommended because they interfere with class work while they are being erected, used, and removed. Cost is also an important factor.

The number of seats to be provided will be determined by the size of enrollment, the college community, and the degree to which there is public demand for admittance. The seating capacity should be set at a minimum of one-half to two-thirds of the student-faculty population. In larger institutions, it may be necessary to install roll-away bleacher seats in the balcony, which, when combined with the bleachers on the main floor, will provide the required number of seats.

The varsity basketball court should be laid out lengthwise in the center of the gymnasium. (See Figure 1 for court dimensions.) If dimensions of 111 by 145 feet are provided, 25 feet are left on either side for bleachers. A minimum of five feet should be left between the first row of seats and the outside boundary line of the court.

Where a permanent balcony is required, it is necessary to plan the line of vision so that the sidelines of the varsity basketball court are plainly visible to the spectators. In this case, the folding bleachers on the floor should be planned to conform to the same line of vision. With the use of roll-away bleachers, added teaching stations can be provided in the balcony.

If the gymnasium is to be used for intercollegiate sports, the number of entrances and exits equipped with panic hardware should meet fire regulations and be ample to control spectator traffic. Traffic patterns for spectators should be such that they do not cross the playing courts or other activity areas in the gymnasium.

The height from the floor to the beams in the main gymnasium should allow that, in normal use of any of the courts, the balls or badminton birds will not strike the lowest ceiling beam. This height should be a minimum of 22 feet to accommodate the rope climb, basketball, volleyball, and badminton.

Where intercollegiate basketball is played, there should be adequate provision for sportswriters. A press box is recommended if conditions permit. The placing of tables adjacent to playing courts is not a good practice. Provision should be made for telephone and telegraph connections, for reception and transmission lines for television, for timing and scoring devices, and for the operation of a public address system, including stereophonic music.

When an area is designed for an activity that will require the use of a piano, phonograph, or tape recorder, a space should be provided for storing this equipment. It is preferable to have a space recessed in the side wall near the place where the instructor will stand to lead the class. Electrical outlets to provide current at all times will be needed for such equipment as amplifiers. A locking, sliding door should be installed for the protection of the instruments as well as the students. All instructional equipment should be on movable carts.

In addition to the niche described above for the storage of the piano and phonograph, there should be a storage room adjacent to the main gymnasium of sufficient size to accommodate the storage of all types of equipment, such as roll-away standards, mats and gymnastic apparatus, and chairs.

Other audiovisual aids can include still and movie projectors, daylight-projection screens, television sets, a scoreboard, a clock, chalkboards, and an intercommunication system.

Concrete is commonly used as a base for constructing the floor of the main gymnasium. Sleepers of from 2 by 2 inches to 2 by 10 inches are laid on edge. Maple tongue-and-groove is the most popular type of wood finish, but synthetic flooring is gaining popularity.

It is suggested that a glazed-tile wainscot be carried up to a height of seven or eight feet. From that point to the ceiling, the concrete or cinder block should be painted in a light color.

Experience has shown that, in general, natural lighting methods have not proved satisfactory. Mercury-vapor or fluorescent lights with diffusion panels have provided satisfactory illumination. (See Part Two, Chapter 7, for lighting specifications.)

There is some evidence that suspended tracks are no longer favored by physical education directors. However, if there is no balcony in the main gymnasium, a track serves as space for spectator seats and also for additional teaching stations.

If a track is constructed, it should be at least eight feet wide and 10 feet above the gymnasium floor. The surface should provide good traction, and the curves should be banked.

The Lobby

The purpose of the lobby is to furnish an area for the control of admission and distribution of traffic and the provision of information. It should contain well-lighted and locked display cabinets, bulletin boards, and directories. These units should be recessed and flush-mounted. Public telephones should be located in or adjacent to the lobby. Other service facilities, the needs for which would be defined by the program, should be provided. Examples are ticket booths, planters, and special decorations. The lobby should be attractive and of sufficient size to accommodate traffic needs. Vestibules should be included for climate control.

The general administrative offices of the building should be located near the lobby. Corridors should lead from the lobby to locker rooms and spectator areas. Probably the most serviceable and attractive floor for the lobby is terrazzo or a material of similar quality. The walls should be constructed of durable material.

A large checkroom for outer wraps should be placed adjacent to the direct line of traffic, but in an alcove or a side room in order to prevent congestion. The location and arrangement of the checkroom should serve the daily as well as special needs of the building. The room should have a long, low counter covered with brass or stainless steel, and it should be possible to lock both the room and counter opening when the facility is not in use. Racks permanently numbered for checking coats and hats should be installed. Shelves should also be provided for storing packages and bags.

Toilet and washroom facilities for men and women should be located near the checkroom. Adequate stairways or ramps should lead from the main lobby to balconies or other spectator areas above the first floor.

Offices

The central administrative offices serve as the nerve center of the entire physical education plant. They should be located near the entrance of the building, inasmuch as all who have business with the department will first come to these offices. The office of the director and those of the various faculty members should be adjacent to a large central office, which will serve as the workroom for the secretarial and clerical staff, as a repository for all departmental records, and as a reception center and waiting room for persons who have business with the department.

The work area of this central office should be separated from the reception-waiting room area by a counter. The reception-waiting room should open into the main corridor of the building. A large closet should be provided adjacent to the work area for the storage of office supplies and records. The administrative head should have his office in or near the central administrative suite. His office should be of sufficient size to accommodate such things as an executive desk, a number of chairs, a file cabinet, and a small work table, which will require approximately 200 square feet. The central administrative office unit should include a conference room near the office of the administrative head of the department. It should be furnished with a conference table large enough to seat the entire physical education faculty, if possible, or the administrative staff in a larger university.

A small cloak room and rest rooms should be located near the conference room. The chairs for the conference room should be upholstered in attractive colors of vinyl materials so they can be kept clean. The conference room should be furnished in light, attractive colors. It is desirable to have a small, fold-away kitchen for refreshments.

Each member of the faculty with major responsibilities should be provided a private office. Ideally, each of these offices should occupy a minimum of 100 square feet and be equipped with necessary office furniture. A workroom with space for a secretarial pool should receive serious consideration.

CLASSROOMS

The physical education complex should include sufficient classroom space, designed primarily for lectures, discussion, and demonstrations. The number, size, and types of rooms will depend upon the anticipated enrollment and curricular offerings. Institutions offering teacher-training programs in health, physical education, recreation, and safety will have need for more specialized rooms than will those concerned primarily with service and basic instruction courses and varsity athletics.

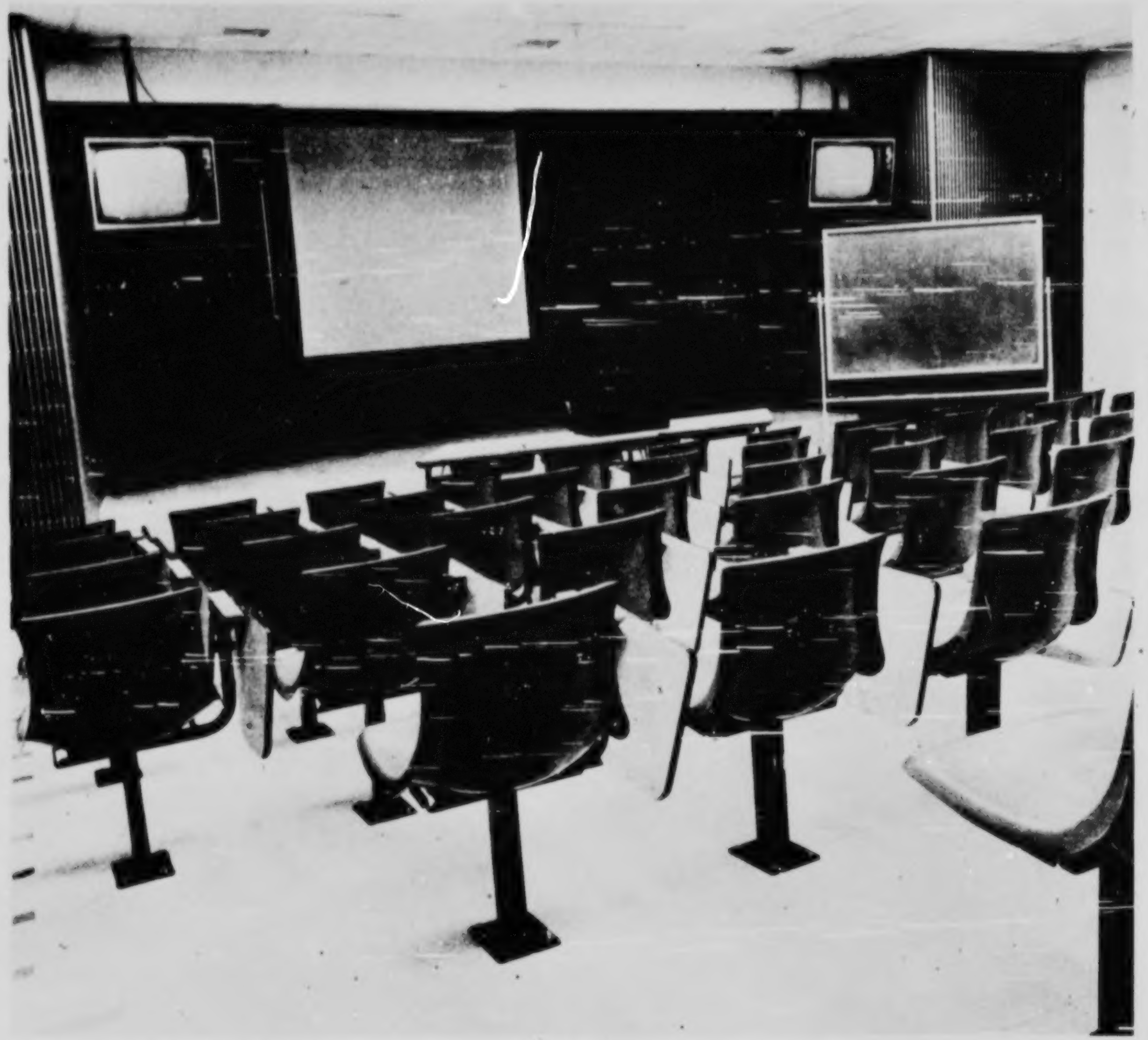
The sizes of classrooms may well vary to accommodate from 10 to 150 persons. The space per student may vary from approximately 18 to 20 square feet per student in smaller rooms down to 12 to 15 square feet per student in rooms for 100 or more persons. Standard classrooms normally seat an average of 10 students. The smaller rooms lend themselves more readily to seminars, conferences, and informal discussions, while an assembly room big enough to combine large groups for professional lectures, clinics, and demonstrations is essential.

Where class size warrants, a wall clock visible from all seats should be installed. Acoustic treatment, adequate lighting, and thermostatically controlled mechanical ventilation should be considered for all classrooms. Each classroom should be provided with chalkboards, tackboards, and hook strips. Electrical outlets for audiovisual equipment should be strategically located with due regard for the convenient placement of controls.

Windows should be equipped with effective and easily operated room-darkening devices. A speaker's platform or podium is frequently desirable in rooms designed for larger groups. Large assembly rooms might well be equipped with a projection booth. A rectangular room is most satisfactory for film projection. Transmission and reception of television, including closed-circuit programs, should be considered when planning modern physical education facilities.

In locating room entrances, consideration should be given to traffic control. The rooms themselves should be placed where they are conveniently accessible yet removed from disturbing noise and distraction.

In smaller classrooms, movable tablet or desk armchairs may be used, or conference tables and straight chairs may be preferred. Large lecture halls and assemblies should be equipped with numbered tablet or desk chairs secured to the floor and so arranged as to provide visual efficiency. It is highly desirable that convenient recessed cabinets and closets be provided for storing instructional materials and personal effects.



University of Utah Classroom.

AUXILIARY GYMNASIUMS AND AREAS

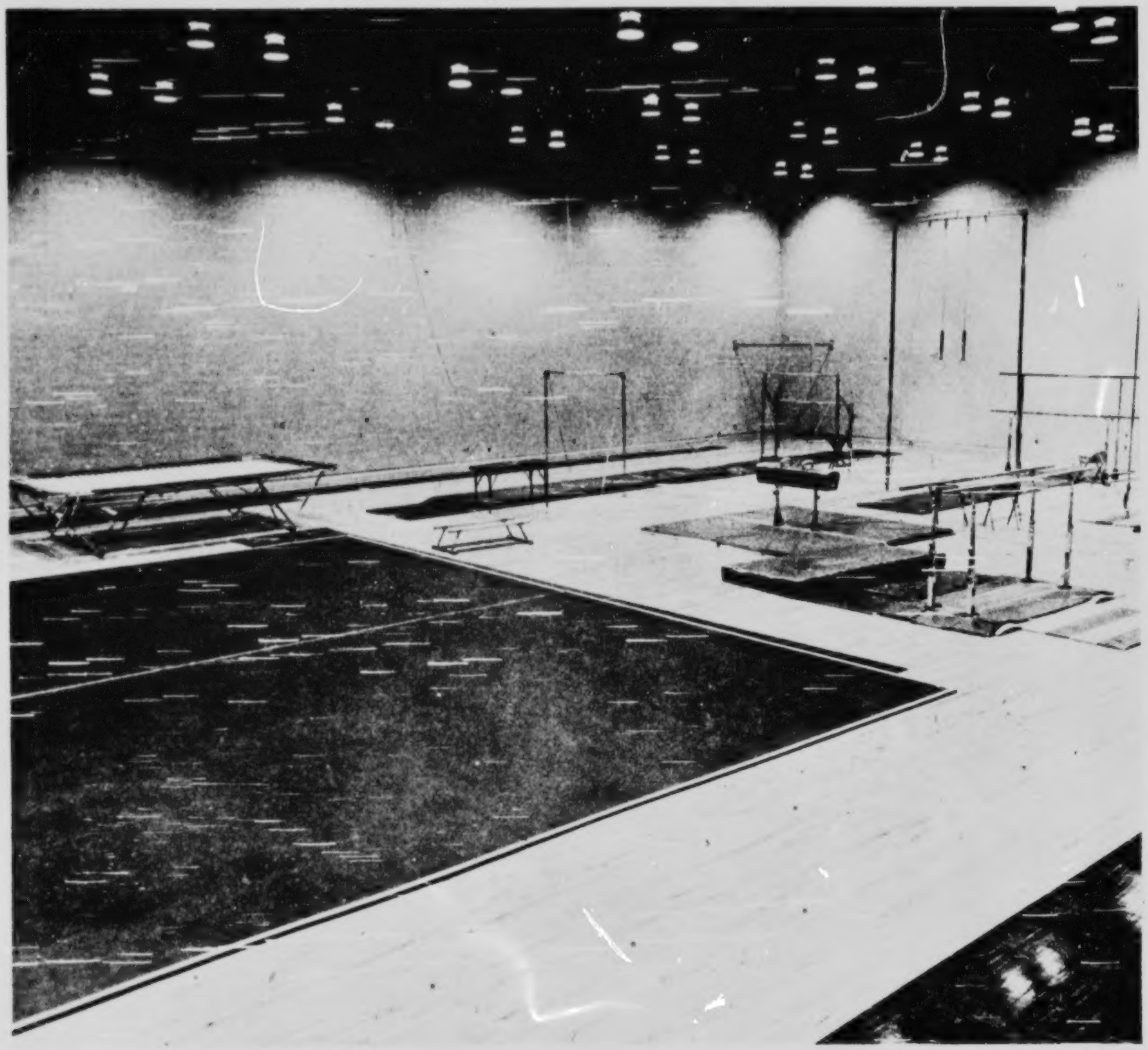
In addition to the large general gymnasium, or gymnasiums, several other gymnasiums may be required for the following:

- Exercise therapy
- Gymnastics
- Weight exercise
- Wrestling and personal defense
- Street-shoe usage
- Dance Areas.

Exercise-Therapy Facilities

Two separate areas should be planned for this specialized program. An exercise-therapy room, designed for individual ameliorative exercises and which can be used as a clinic, is the basic requirement. A gymnasium for adapted activity is necessary for students assigned to this program.

The exercise-therapy room should be on the ground floor, if possible, or accessible to an elevator. It should be well-lighted, and the walls and floor should be attractively finished to lend a cheerful atmosphere. The size of the room is determined by the number of students needing this special attention. Approximately 70 square feet of floor space is required per student. To accommodate equipment, the minimum size of the room should be 1,600 square feet. Office space should be located within this area, and the office should be equipped with large glass windows for adequate supervision of the room. The room should be well-ventilated, with air-conditioning provided where necessary. The dressing and toilet facilities should be close to the exercise-therapy room and should be adjusted to the needs of the handicapped. A sink or wash basin should be provided in this facility. Doors



University of Utah Gymnastics Room.

and windows to the room should be designed for privacy. A curtained area should be provided for changes of equipment or appliances when privacy is desired.

Permanent equipment installed in the exercise-therapy room should include stall bars, wall weights (pulley), press bar, weight racks, shoulder wheel, finger ladder, hanging bars, overhead ladder, push-up bars, wall charts and anatomical drawings, single and triple mirrors, and walking rails.

Removable equipment should include plinths (treatment tables) 26 by 72 by 30.5 inches, stall-bar benches, incline boards 81 by 30 by 3 inches, ankle exercisers, a bicycle (stationary), weights (dumbbells and barbells), exercise mats, single and double iron boots, parallel bars (low), orthopedic stairs, rowing-machine stools, scales, an Elgin table (or improvisation of quadriceps exercise table), wrist rollers, neck-traction halters, cushions or pillows, crutches, a wheelchair, dynamometers (hand, spring cable), goniometers, a chalkboard, and a skeleton.

The equipment in an adapted-activities gymnasium should be the same as in a regular gymnasium, with necessary adaptations. This gymnasium should be in close proximity to the exercise therapy room so that students can use both facilities.

Gymnastic Facilities

With the recent nationwide surge of interest in gymnastics, there has been a renewed support of instruction in this field. Gymnastics make a unique contribution toward overcoming a lack of development of the upper body, which is often neglected in other sports. Gymnastics contribute to building strength, agility, flexibility, coordination, balance, and posture. They also contribute to the mental qualities of alertness, daring, and precision; the character trait of self-discipline; and fun and enjoyment. These values, together with those of preventive and corrective action, place gymnastics in a position of major importance in physical education.

In addition to the main gymnasium where gymnastic meets, exhibitions, and other competitions are held before a viewing public, a separate gymnasium should be provided for the permanent installation and storage of apparatus and equipment and for instruction in gymnastics. The dimensions of this gymnasium should be determined by space requirements needed to accommodate the apparatus and equipment to be installed, by space needs for performance in gymnastics, and by total school enrollment and interest in gymnastics. Ideally, the size of this gymnasium should be 120 by 90 feet, with a minimum ceiling height of 23 feet. This height permits a clearance of 22 feet for the rope climb and is ideal for hanging the various mechanical systems used in gymnastics. Some have found it desirable to install tracks on the ceiling supports to make it possible to use trolleys for moving equipment and for attaching safety belts used in the instruction of trampolining and tumbling.

The safety of performers and instructors should receive major consideration in planning the location and installation of apparatus, equipment, and wall fixtures. Apparatus used in performance should be so located that performers do not interfere with each other when going through their routine. Flying rings should be located so that there is at least 15 feet of free space at each end of the swinging arc. All equipment should be installed according to a plan that will permit, without interference, a full range of movement, including the approach. Mats should be laid completely around the area of performance on horizontal and parallel bars.

Floor plates for attaching equipment should be recessed and flush with the floor. It may be necessary to reinforce the floor to install floor plates adequately where tension is unusually severe. Wall boards should be securely installed to the wall when equipment is attached to it. Apparatus suspended from the ceiling should be securely attached to metal supports.

The ceiling should be acoustically treated. Lights should be shielded and adequate for the program (see Part Two, Chapter 7). Doors should be constructed without a threshold and wide enough to accommodate the movement of equipment to other areas. Maple has many advantages over other types of flooring. The facility should be air-conditioned in accordance with standard specifications. Wall construction should be of the same materials as recommended for other gymnasiums.

A common failure in planning is to overlook the need for adequate and conveniently placed storage space for gymnastic equipment. If multiple use of this equipment is expected, transportation carts and dollies should be provided. Specifications on size and installation of the various pieces of apparatus and equipment may be obtained from the manufacturers. Ideally, the gymnasium for gymnastics should be equipped with the following types of items: side horses, horizontal bars, long horses, parallel bars, bucks, trampolines, mats, rings, and other special apparatus.

A gymnastic landing pit, 10 feet wide, 20 feet long, and 30 inches deep, filled with sponge rubber—for use with parallel bars, horizontal bars, still rings, and tumbling—is a new development in construction for gymnastics.

Weight-Exercise Room

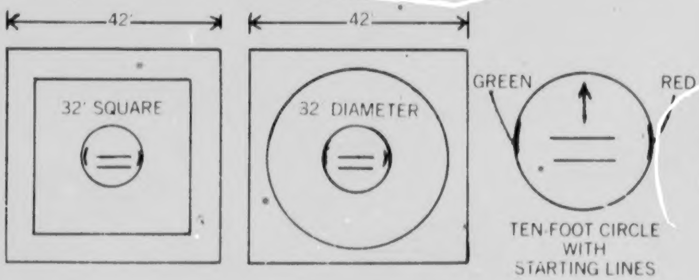
This room should contain a minimum of 2,500 square feet of floor space. Such space will provide a weight-training area and space for the practice of official events in competitive weight lifting. It is recommended that the floor of this room be covered with a durable, resilient material. A flooring of this type makes it unnecessary to use weight platforms, which are essential to protect a maple or other wood flooring.

The weight-lifting area should be roped off and should be approximately 15 by 15 feet for the practice of official lifts. The rest of the room may be used for exercise with barbells, dumbbells, isometric cables, and the like. Several full-length mirrors should be installed on the walls. Barbell and weight racks should be attached to the walls so that the room may be kept tidy.

Wrestling and Personal-Defense Room

This room is designed for wrestling, judo, and personal-defense activities. Part Two, Chap. 2, Art B. The ceiling should be of acoustic material and should be a minimum of 12 feet. It should be rectangular in shape and should contain two square mats measuring 42 by 42 feet (see Figure 2). The floor area not covered by the regulation mats should be covered wall to wall with the same type of mat material. The room should be at least 42 by 84 feet. A satisfactory standard is 10 square feet per sudent during peak usage.

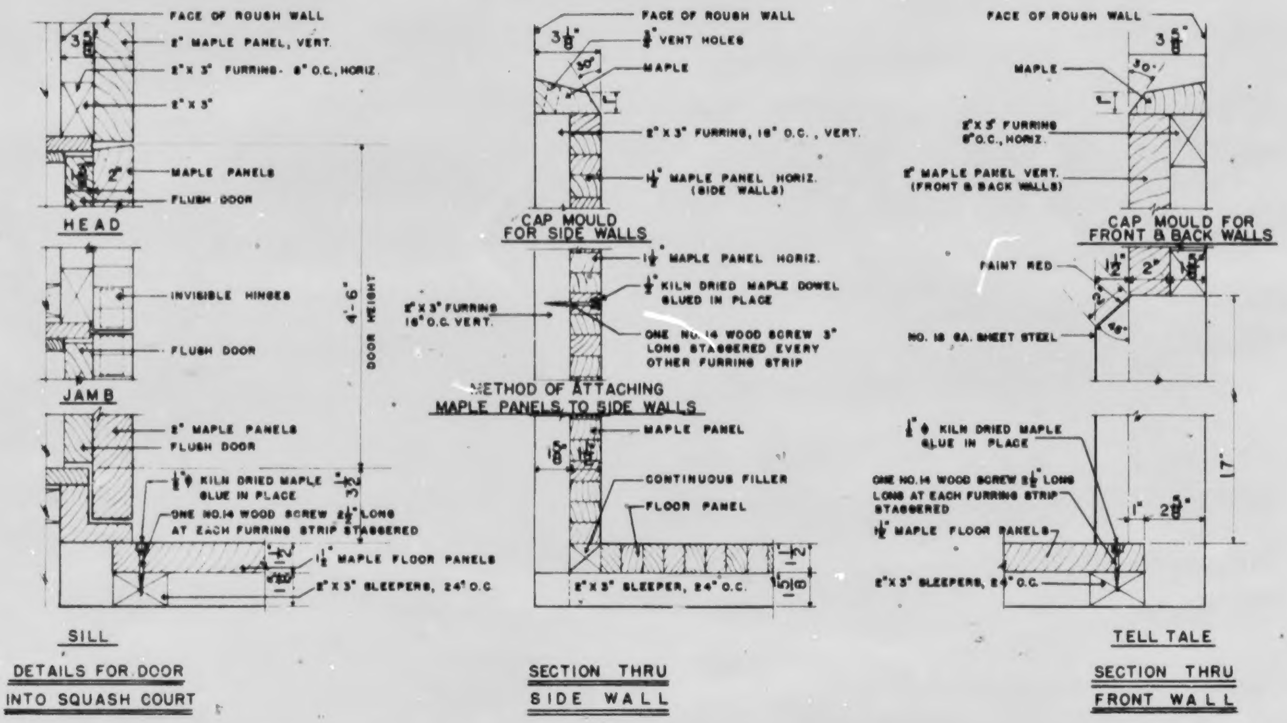
The floor of the wrestling room should be constructed of, or covered with, resilient material to prolong the life of the mats. These materials may be rubberlock products, other



Minimum mat size provides for a circle with a diameter of 28 feet as a legal wrestling area or a 24-foot square wrestling area with a mat area of at least five feet in width which extends around the wrestling area proper.

Figure 2. Wrestling Mats.

DETAILS OF PRE-FABRICATED CONSTRUCTION


FACE OF ROUGH WALL
3 5/8"
2" MAPLE PANEL, VERT.
2" X 3" FURRING - 8" O.C., HORIZ.
2" X 3"
2"
MAPLE PANELS
FLUSH DOOR
HEAD
INVISIBLE HINGES
FLUSH DOOR
JAMB
4'-6"
DOOR HEIGHT
2" MAPLE PANELS
FLUSH DOOR
1/2" ⌀ KILN DRIED MAPLE GLUE IN PLACE
3"
ONE NO.14 WOOD SCREW 2 1/2" LONG AT EACH FURRING STRIP STAGGERED
1 1/2" MAPLE FLOOR PANELS
2" X 3" SLEEPERS, 24" O.C.
SILL
DETAILS FOR DOOR INTO SQUASH COURT
FACE OF ROUGH WALL
3 1/8"
3/8" VENT HOLES
30°
MAPLE
1"
2" X 3" FURRING, 16" O.C., VERT.
1 1/2" MAPLE PANEL HORIZ. (SIDE WALLS)
CAP MOULD FOR SIDE WALLS
1 1/2" MAPLE PANEL HORIZ.
1/2" KILN DRIED MAPLE DOWEL GLUED IN PLACE
2" X 3" FURRING 16" O.C. VERT.
ONE NO. 14 WOOD SCREW 3" LONG STAGGERED EVERY OTHER FURRING STRIP
METHOD OF ATTACHING MAPLE PANELS TO SIDE WALLS
MAPLE PANEL
1 5/8"
1 1/2"
CONTINUOUS FILLER
FLOOR PANEL
2" X 3" SLEEPER, 24" O.C.
SECTION THRU SIDE WALL
FACE OF ROUGH WALL
3 5/8"
MAPLE
30°
1"
2" X 3" FURRING 8" O.C., HORIZ.
2" MAPLE PANEL VERT. (FRONT & BACK WALLS)
CAP MOULD FOR FRONT & BACK WALLS
PAINT RED
1 1/2"
2"
1 5/8"
2"
45°
NO. 18 GA. SHEET STEEL
17"
1/2" ⌀ KILN DRIED MAPLE GLUE IN PLACE
ONE NO.14 WOOD SCREW 2 1/2" LONG LONG AT EACH FURRING STRIP STAGGERED
1"
2 5/8"
1 1/2" MAPLE FLOOR PANELS
2" X 3" SLEEPERS, 24" O.C.
TELL TALE
SECTION THRU FRONT WALL

DETAILS OF STANDARD CONSTRUCTION

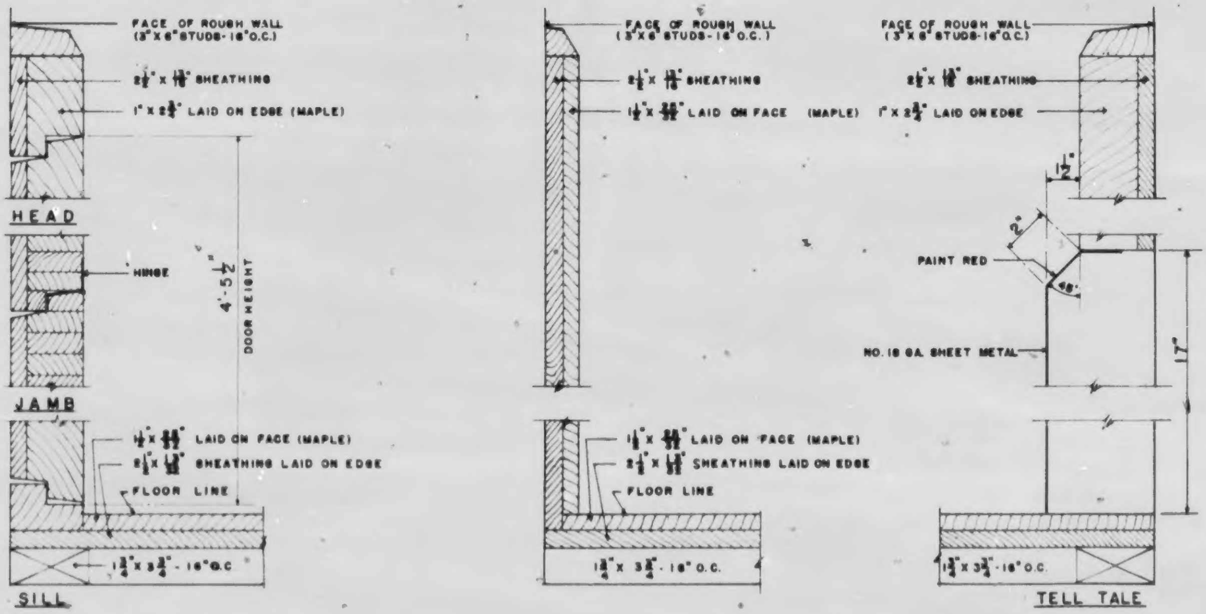

FACE OF ROUGH WALL (3" X 6" STUDS - 16" O.C.)
2 1/4" X 13/16" SHEATHING
1" X 2 3/4" LAID ON EDGE (MAPLE)
HEAD
HINGE
4'-5 1/2"
DOOR HEIGHT
JAMB
1 1/2" X 25/32" LAID ON FACE (MAPLE)
2 1/4" X 13/32" SHEATHING LAID ON EDGE
FLOOR LINE
1 3/4" X 3 3/4" - 16" O.C.
SILL
FACE OF ROUGH WALL (3" X 6" STUDS - 16" O.C.)
2 1/4" X 13/16" SHEATHING
1 1/2" X 25/32" LAID ON FACE (MAPLE)
1 1/2" X 25/32" LAID ON FACE (MAPLE)
2 1/4" X 13/32" SHEATHING LAID ON EDGE
FLOOR LINE
1 3/4" X 3 3/4" - 16" O.C.
FACE OF ROUGH WALL (3" X 6" STUDS - 16" O.C.)
2 1/4" X 13/16" SHEATHING
1" X 2 3/4" LAID ON EDGE
1 1/2"
2"
PAINT RED
45°
NO. 18 GA. SHEET METAL
17"
1 3/4" X 3 3/4" - 16" O.C.
TELL TALE

Figure 3. Squash Court Construction.

NOTES

1 WALLS AND FLOOR MAY BE CONSTRUCTED ACCORDING TO STANDARD OR PRE-FABRICATED DETAILS AS SHOWN.

2. ALL COURT DIMENSIONS SHOWN IN ISOMETRIC DRAWING ARE TO FINISHED SURFACE OF WOOD WALLS AND FLOOR.

3. DIMENSIONS FOR RED LINES TO BE PAINTED ON FLOOR AND FRONT WALL ARE TO THE INSIDE OF ONE INCH WIDE LINE.

4. MOULDING AT TOP OF PLAYING WALLS TO BE PAINTED RED.

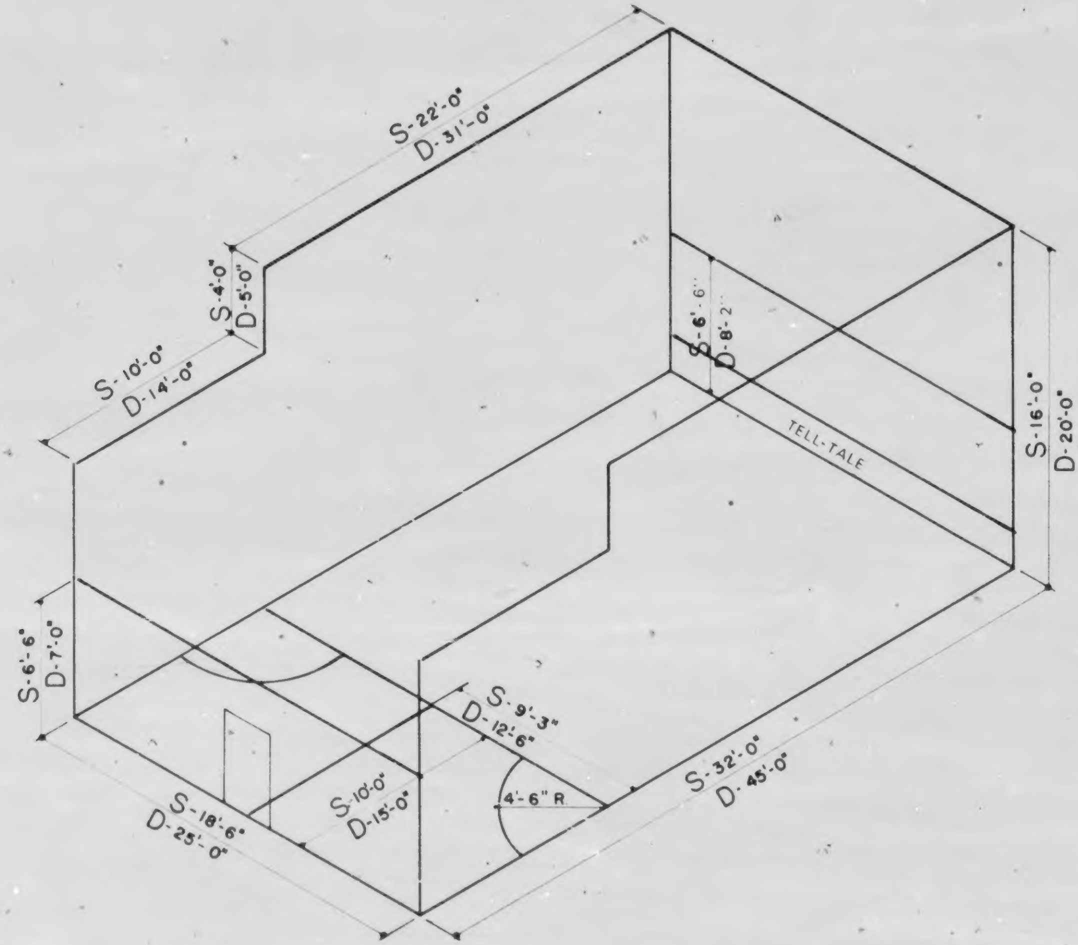
5. MINIMUM CLEAR HEIGHT FROM FLOOR TO BOTTOM OF LIGHT FIXTURES SHOULD BE 18'-0" FOR SINGLES AND 22'-0" FOR DOUBLES.

6. GRILLES MAY BE PLACED IN FACE OF TELL-TALE FOR VENTILATION OF COURT.

7. BALCONY MAY VARY TO SUITE CONDITIONS, IS USUALLY LOCATED AT BACK OF COURT, BUT IS ALSO PERMISSIBLE AT THE SIDE AND FRONT WALLS.

8. IF POSSIBLE, FANS SHOULD BE PROVIDED FOR CIRCULATION OF OUTSIDE AIR.

9. CONSULT OFFICIAL YEARBOOK FOR ADDITIONAL SPECIFICATIONS.



ISOMETRIC

DIMENSIONS SHOWN ABOVE PRECEEDED BY "S" ARE FOR A SINGLES COURT; BY A "D" ARE FOR A DOUBLES COURT

DETAILS AND DIMENSIONS FOR SQUASH COURT CONSTRUCTION

PAUL MONAGHAN, JR. ARCHITECT

CONSULTING ARCHITECT FOR THE UNITED STATES SQUASH RACQUETS ASSOCIATION newly developed resilient materials, or wood. Concrete is not recommended. The mats should be of plastic materials and the walls should be covered with resilient materials up to five feet above the floor on all sides. Adequate lighting properly screened and forced ventilation are essential in this room.

Street-Shoe Usage Room

The size of this room should be approximately 70 by 90 feet. A floor for street-shoe usage may be needed in any size college or university and in a program with a variety of offerings. The floor most commonly used for this purpose is hard maple, tongue-and-groove, conventional gymnasium flooring. Square dance, folk dance, social dance, physical education for elementary teachers, marching and band practice, and similar activities can be conducted on such a floor. It can meet the demands of such special college and community events as musical and dramatic productions, fairs, and carnivals. The "make-up" room or "warming room" for department and college outdoor programs can be housed in this area and can be served through a door leading to a corridor and immediately to the out-of-doors.

This street-shoe room, when not scheduled in some manner as indicated above, can serve the purposes of any regular gymnasium if so planned in its equipment and floor markings. The floor will need some extra maintenance for the hard use it will receive, but the desirability of the activities that may be scheduled on it will justify the usage and resultant wear.

Game Room

This is a multiple-purpose room, and its use will determine its dimensions. It should be large enough to accommodate at least six table-tennis tables. A ceiling height of 12 feet is adequate. The room should be equipped with a public-address system and record player for instructional and recreational activities, including social and square dancing. This room should be accessible from the lobby or from a building corridor. It should have small-kitchen facilities and a floor that can take hard usage. The disabled should be considered in the planning.

DANCE FACILITIES AND EQUIPMENT

These materials present the conditions for ideal dance facilities.

Basic Assumptions

The essential facilities and equipment should be supplied in sufficient quantity and quality to provide for all dance activities in the required and elective curriculum and in the extracurricular programs. Particular attention should be given to adequate provisions for the program of professional preparation (both the teaching program and the performance program) and to dance performance and observation.

Provision should be made to include the following units in the dance facility:

- Locker-dressing rooms
- Shower area
- Toilets
- Rest rooms (remote from toilets and showers)
- Public lavatories
- Therapy room
- Storage spaces
- Construction rooms for costumes, props and sets, and music (composing and recording)
- Custodial space
- Office space
- Laundry and cleaning facilities
- Box office
- Parking area.

The following equipment should be provided: electrical installation, lighting equipment, acoustics, ventilation, heating, floors, walls, sanitation, safety, drinking fountains, sound system, filming and taping facilities, installation of fixed equipment, movable equipment, and lines of traffic.

Dance facilities should be designed to serve both sexes. The dance facility should be readily accessible to outside entrances and should be a unit unto itself even if it is attached to, or a part of, another building. The dance complex should be constructed, decorated, and furnished in an aesthetically pleasing manner and suitable for the pursuit of dance as an art form.

Criteria for Determining Facility Needs

Total facilities should be determined according to the amount of emphasis placed on various aspects of the dance curriculum. Considerations should include classes needed and areas for individual work and for extracurricular and concert practice. Based on the design of the dance curriculum, facilities should be considered in terms of teaching space, practice space and choreography, rehearsal space, performance space, research space, auxiliary space and equipment, and classroom space. At least two distinct areas should be provided, one area for folk and social dance and one area for modern dance and ballet.

Principles of Planning Facilities

The potential users of the dance facility should be consulted. Consultants, engineers, architects, administrative officials, and teachers should be involved in the planning. Facilities should be planned to meet predicted future demands as well as immediate needs.

Disturbing factors such as noises, odors, and traffic should be eliminated. The placement of the dance area adjacent to the related arts, particularly music and theater, is highly desirable. Accessibility in terms of location and parking facilities for audience members should be considered.

Facilities must comply with local and state building codes and professional standards for proper and maximum usage and should serve fully the purpose for which they are intended. Facilities must also conform to safety and sanitation codes in the location, arrangement, use, and maintenance of buildings and areas.

Costs of planning, constructing, and maintaining a facility should be considered in relation to long-range plans for efficient and maximum use. Expediency should not determine cost. Plans should be based on predicted needs and provide for expansion at minimum cost. Flexibility of design to permit change is essential.

Facilities should be attractive, harmonize with the surrounding vicinity, and capitalize on the natural features of the topography. They should be designed so that maximum and easy supervision is possible.

Construction of Modern Dance and Ballet Area

A minimum of 100 square feet per person is recommended. An area of 3,000 square feet will accommodate 30 students. If an area is to serve as an informal theater and instructional area, it should be between 4,800 and 5,000 square feet to accommodate both the class and the needs of the theater section.

A ceiling height of 24 feet is recommended for all dance areas. Full height is essential for large dance areas (over 2,400 square feet), and 16 feet is the minimum height for small dance areas.

Dance activities require air space between floor and foundation as well as "floating" floors for resiliency. Floors should be of hardwood, such as maple, of random lengths, and tongue-and-grooved. They should be laid with the grain going in one direction. The floors should not be slippery, and they should be constructed for easy cleaning. The finish should provide a smooth surface upon which dancers can glide with bare feet or soft sandals. Tung oil is considered by most to be a satisfactory finish; an alternative might be several coats of wood sealer.

Walls should be smooth and easily maintained. Consideration should be given to having one unobstructed wall of neutral background for filming purposes. To support ballet barres, stress factors of the walls should be considered. Thin walls are inadequate.

Incandescent light is preferable to fluorescent light. Lights that also serve as houselights during performances should be controlled from wall switches as well as from the light control board.

Consideration should be given to natural lighting. Large windows contribute to an aesthetically and psychologically desirable atmosphere. To avoid direct sunlight, the best location for windows is the north wall. Windows should be curtained so the studio can be darkened for film showing and studio performances. When total construction necessitates no windows, the aesthetics may be improved by the use of color on the walls.

When one studio is directly over another or over offices, acoustic treatment is necessary. Placement of sound equipment such as record player, turntable, microphones, and speakers should be considered in initial planning. An adequate number of speakers, installed near ceiling height, should be located so participants can hear both music and instruction. Heavy equipment should be placed on stands of table height equipped with rollers. Electrical outlets should be located close to where equipment will be used.

Storage space for sound equipment should be adjacent to the dance area and locked. Storage rooms should have double doors and a flush threshold for easy movement of such large equipment as a piano. Built-in storage space for records, sound equipment, tapes, and musical instruments should be provided. An area in the storage room where instructors can listen to records and tapes is highly desirable. This area should have adequate acoustics, ventilation, and electrical outlets.

Heavy-duty wiring is essential for all dance facilities. Wiring should be capable of carrying a portable light board as well as phonographs, additional speakers, tape recorders, and projectors. Wall outlets should be plentiful. Television conduits should be installed when the building is constructed.

Temperature should be maintained at 65 degrees. The air should be well-circulated, and consideration should be given to the use of natural air. Mechanisms for heating and circulating air should be as nearly silent as possible to avoid interfering with the quality of sound and its reception.

Planning for a dance facility should include consideration of accessories. Leaf-fold mirrors, which can be folded for protection or curtained during performances, may be installed along two adjoining walls so that movement can be analyzed from two directions. Wall mirrors should be installed flush with the wall and raised 12 to 18 inches from the floor.

Ballet barres should be smooth in texture and be made of wood, stainless steel, or aluminum. The minimum length to accommodate one dancer is five feet. Barres from 42 to 48 inches in height may be installed permanently; they should extend six to eight inches from the wall. If necessary, barres may be placed in front of mirrors. In such instances, it may be necessary to use pipes for the barres. The barre supports may be screwed into recessed floor sockets just in front of the mirror, thus facilitating the removal of the barre and supports when not needed.

Custom-made percussion cabinets mounted on rollers are a fine accessory. They may have a carpeted top surface, slide-out drawers lined with felt for small instruments, and larger partitions to accommodate cymbals and drums. Heavy sound equipment should be built-in or placed on stands of table height equipped with rollers for ease of transportation. Because moving affects the tuning of a piano, this instrument should be placed on an inside wall where it will not be subjected to extreme heat or cold, and it should be protected by a suitable cover and lock.

If it is to be moved frequently, the piano should be placed on a heavy-duty dolly.

Chalkboards and tackboards are useful accessories. A glass-enclosed exhibit case for photographs, costumes, costume plates, manuscripts, and other items may be installed near the dance area.

Instructional and Laboratory Facility Needs

There should be a minimum of one large teaching and performing area. This area should have a 24-foot ceiling and resilient floors. It should be equipped with special lighting for performance, sound equipment, communications media, an observation balcony, and good ventilation and lighting. Two additional areas should be provided, an area for ballet and modern dance and an area for social and folk dance. Provision should be made for well-designed and well-equipped classrooms and seminar and lecture rooms for instructional use.

In addition to the performance area, there should be rehearsal space that is somewhat larger than the area designed for performance. There should be an area for practice and choreography that is equipped with phonographs and tape machines. A library and reference room with an adjoining study area for books, music, records, tapes, and copying machine should be available. Provision should be made for a soundproof recording studio large enough to accommodate a piano and small orchestra, turntables, and tape recorder. It should have built-in shelves for storage and be not less than 300 square feet. Storage space for musical instruments should be provided.

Dance Production Areas

While a well-equipped theater is the ideal dance performance area, it is not always possible to have such a facility. The alternative is to provide a large area for both instructional and performance activities. The area may be equipped with a balcony for observation of classes and for audience seating during performance. Other seating arrangements may also be desirable. A large area may be equipped to provide for arena or proscenium staging or both.

ARENA STAGE

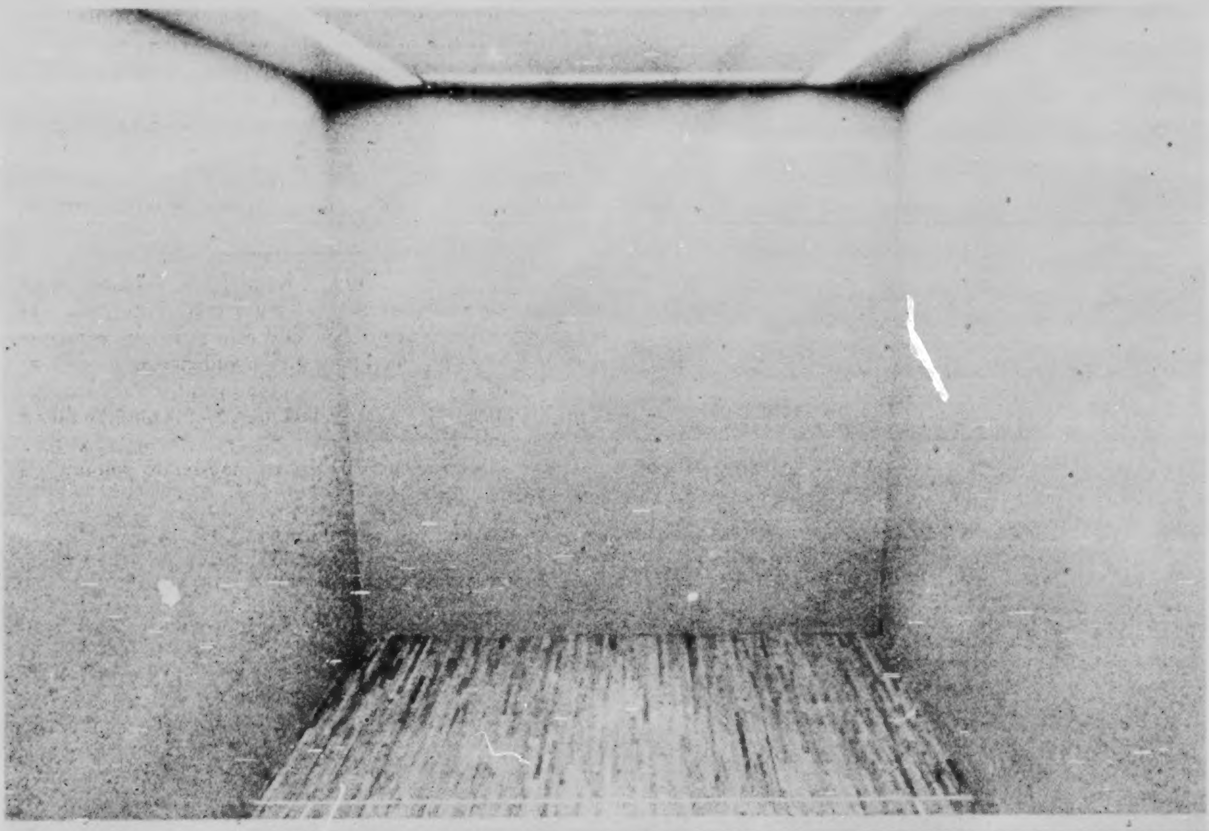
The performance area of an arena stage should contain between 875 and 1,200 square feet. The most desirable seating capacity for performances should accommodate 300 to 500 people. The entire performance area should be visible from all seats. The seating arrangement should be flexible. Seats may be on movable risers so space may be used in a variety of ways. Raked seating is essential. Adequate entrances and exits should be provided.

Lighting should be available from all directions. It should be possible to use gels on all lights except houselights. All lights should be on separate dimmers, and a sufficient number of electrical outlets should be available. When possible, all lights should be operated from a single console within the control booth.

Sound and light equipment should be operated from control booths. Speakers for amplification should be placed so both performers and audience can hear. Wiring should be adequate to carry a portable light board, phonograph, tape recorder, speaker system, and projector.

PROSCENIUM STAGE

The minimum performance area on a proscenium stage



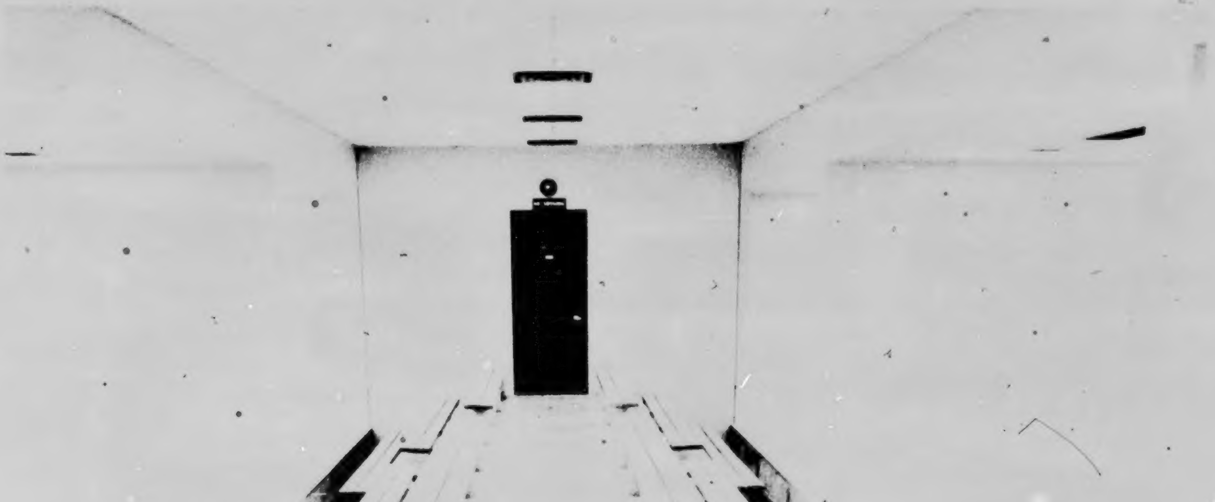
University of Utah Handball Court.

should be 1,200 square feet (30 by 40 feet). The two wing areas combined should be equal to the amount of visible stage space. Space should be provided for musicians, chairs, and lighted music stands. Placement of musicians should not interfere with the visibility of the stage or the sound of the music.

The entire performing area should be visible from all seats. The number of seats should be planned for estimated size of audience.

Hand control for the front curtain is preferable to mechanical controls. Flexible tracks to move the curtain horizontally should be considered. Side curtains (legs) or flats should be provided on both sides of the stage for entrances and exits. Asbestos teasers and tormentors are needed for safety and masking. Battens to be used for hanging scenery, sky drop, or film screen should be suspended above the visible stage area. Provisions should be made for lowering and raising battens for the attachment of scenery. Lines should be attached to a pin rail located at the side of the stage. The back wall should be free of visible obstructions. Curtains and flats should be light in weight, absorbent, and of neutral or dark color.

Provision should be made for side lighting, front strip lighting, and overhead border lighting. (Three separate circuits should be provided, to be used singly or in combination.) There should be front ceiling beam lighting, balcony lighting, or both. Crawl space should be provided in the ceiling above beam lights to permit focusing and repair work. It should be possible to use gels on all lights except houselights. All lights should be on separate dimmers. A sufficient number of electrical outlets should be located in floor sockets in the wing space. A low-wattage light should



University of Utah Observation Area, Handball Courts.

be installed for cuing performers and crew members at the side of the front stage. When possible, all lights should be operated from a single console within the control booth.

Sound equipment should also be operated from the control booth. Speakers for amplification should be placed so both performers and audience can hear. An intercom should be used to link the backstage, dressing rooms, and control booth. Telephones to handle outside calls should be located in the box office and backstage. The backstage phone should be equipped with a signal light.

Control booths for lights, sound, and projections should be centered at the audience end of the facility and should include soundproofing, a large window for viewing the stage, built-in counters and shelves for storing equipment, and an intercom for communicating with the backstage area.

AUXILIARY AREAS

A costume room for constructing, fitting, cleaning, and storing should be a minimum of 400 square feet and be equipped with or accessible to a cutting table, one or two sewing machines, a three-way mirror, ironing boards and steam irons, washing machine and dryer, two laundry tubs, a cleaning machine, built-in cabinets with shelves and drawers, racks for hanging and storing costumes, a double door with a flush threshold to facilitate moving costume racks, and a tackboard and chalkboard affixed to one wall.

Dressing rooms should be provided for men and women. They should be equipped with costume racks, chairs, wash basins, lighted mirrors, toilets and showers, and a first-aid kit.

The make-up room should be located between the men's and women's dressing rooms and should be furnished with lighted mirrors, built-in shelves, make-up tables, chairs, wash basins, and storage space.

The scene and prop room should be located as close to the stage area as feasible. It should be a minimum of 400 to 500 square feet and have a ceiling height of at least 16 feet, although 24 feet is preferable. The floor should have a paint-resistant surface. Proper ventilation is necessary to avoid fumes from paint and glue. The room should be furnished with built-in bins and shelves for storage of nails, brushes, screws, paints, and glues; a pegboard mounted flush with the wall for hanging tools; a built-in workbench; a wash sink; outlets for electrical tools; and a chalkboard and tackboard. Storage space for props should be a minimum of 500 square feet with a 24-foot ceiling; it should be easily accessible to the backstage area.

The box office should have locked racks for tickets, a locked drawer for currency, a telephone with an outside line, and an intercom to the backstage area.

It is desirable to provide a social area where the audience and performers may meet following a production. It should be situated adjacent to the performing area and include attractive decorations, a comfortable seating arrangement, display cases, and an adjoining small kitchen for preparing refreshments.

Construction of Folk and Social Dance Area

An area of 5,400 square feet (54 by 100 feet is suggested) will accommodate a class of approximately 60 students. Dance areas are generally rectangular with a length-width ratio of approximately 3 to 2 (e.g., 90 by 60 feet). Ceiling height should be in proportion to the size of the room but never lower than 12 feet. An outside entrance into a main corridor of the building will provide for traffic flow of the relatively large groups using the area.

Floors as specified for ballet and modern dance are necessary. An epoxy finish will enable the use of street shoes without damage to the floor. Specifications for lighting, ventilation, acoustics, sound equipment, storage space, wiring, and temperature control should follow those for ballet and modern dance facilities.

Racks for coats and books should be installed either within the dance area or along the outside corridor wall.

Tackboards, chalkboards, and display cases are highly desirable.

OFFICE SPACE

There should be central offices for unified administration. A private office and conference space for the director of the dance programs should be available. There should be office space for faculty and for technical personnel. Supporting space for office equipment and storage should be provided.

Auxiliary Space

It is desirable to have a reception-social room (with adjoining kitchen) for use by students, faculty, and community groups on special occasions. Locker-shower areas should be available for students and faculty of both sexes. In addition, a faculty conference room should be provided, and a rehabilitation or therapy room is desirable.

The fixed capital outlay plus the operating and equipment costs of these facilities represent large budgetary items. Therefore, every effort should be made to select a suitable site, ensure proper maintenance and care, and provide adequate supervision and maximum use.

SPECIAL INSTRUCTIONAL AND ACTIVITY AREAS

Handball Courts

Handball is a vigorous competitive sport long recognized as an essential activity for a college physical education program. Depending on the size of the institution and the expressed interest in handball, one or more batteries of four-wall handball courts should be provided. See Part Three, Chapter 1, for the dimensions and diagrams of the playing area.

When more than a single battery of courts is to be constructed, the batteries should be arranged so the back walls of each battery are separated by a corridor approximately 10 feet wide and eight feet high. A corridor located immediately above and at least 12 feet high may serve an instructor or be used as a spectator gallery. Corridors and galleries should be illuminated with indirect light.

The back wall of a single court need not be higher than 12 feet. Shatterproof glass may be used to enclose the remainder of the back wall. The use of wire mesh for this purpose is of questionable value. Many courts are satisfactorily used with an open upper rear wall.

Handball courts may be constructed of hard plaster, concrete, shatterproof glass, or a nonsplintering durable wood. While plaster is sometimes recommended, it would be wise to consider courts constructed of other materials because of maintenance costs. Glass courts provide maximum spectator participation, but the initial cost may be prohibitive. Hardwood construction is most satisfactory. Open-balcony construction interferes with individual-court air-conditioning.

Front walls may be constructed of hard maple laid on diagonal wood sheathing. Studding should be placed close enough to prevent dead spots. Centered studs of a maximum of 16 inches are recommended. A costly but desirable front-wall construction is hard maple laid on edge grain.

Side and back walls may be of such nonsplintering durable wood as yellow pine or hard maple. Some side and back walls constructed with one-inch, tongue-and-groove, marine plywood have been satisfactory and economical. Hardwood floors of standard gymnasium construction are recommended. Plaster ceilings have proved satisfactory. All interior surfaces should be painted with eggshell-white enamel.

Entrance doors should open toward the corridor and have flush pulls and hinges. A small shatterproof window installed flush with the interior surface of the door should be located at approximately the eye level of an average adult male.

Such fixtures as heat pipes, ventilating ducts, lights, and other mechanical equipment should not project into the playing area. Ventilating ducts and lighting fixtures are best installed flush with the ceiling surface. Provision for replacement of light bulbs from above is a desirable feature.

A single light switch to control all lights in each court should be placed on the corridor side and near the entrance door. Warning lights, located outside each court, should indicate when a court is being used. By use of a sturdy push button, lights can be turned on when an entrance door is closed.

Refrigerated air-conditioning, or at least forced ventilation, is essential for individual courts. The ventilation switch can operate in conjunction with the light switch. Climatic conditions may dictate separate switches.

Squash Courts

Squash is very popular in some localities and should be provided for in the physical education program. It is recommended that at least one singles and one doubles squash court be included in a physical education complex. A singles court is 18.5 feet wide by 32 feet long and 16 feet high. A doubles court is 25 feet wide by 45 feet long and 20 feet high. (See Figure 3 and Part Three, Chapter 1, for additional specifiications). The number of courts should be determined by the interest in this activity in a given community.

It is possible to install movable metal "telltales" across the front of handball courts so they can be used for squash. The floors, walls, ceilings, lighting, heating, and ventilation of squash courts are similar to those of four-wall handball courts.

The official rules of the United States Squash Racquets Association and the National Squash Tennis Association should be consulted in planning and constructing squash courts.

Rowing-Practice Facilities

In certain colleges and universities, it may be desirable to construct facilities for indoor crew practice. Colleges engaging in competitive rowing will require either fixed rowing machines with accompanying mirrors to reflect the action of the rowers, or a rowing-practice tank. The rowing machines may be installed in a special activity room. If there is space underneath the spectator area in the main gymnasium, they may be installed there. In every case, the area should be well-lighted and ventilated.

The rowing tank, when used, should simulate the conditions to be found in open-water rowing. The water should be mechanically circulated in such a manner as to make possible the actual introduction of the oar into the water and the completion of the stroke. The crew should be seated on a rigid platform that spans the pool at actual shell height.

Group Study Rooms

If the gymnasium is to serve the needs of students enrolled in a major professional program, the inclusion of small-group study rooms is recommended. Study rooms should occupy approximately 150 square feet and should be equipped with a large table and sufficient chairs to accommodate a maximum of eight students. These rooms may serve a variety of educational needs in addition to small-group on-campus study.

"In-Uniform" Study-Hour Rooms

In gymnasium buildings, there is a need for rooms where men and women students who have one free hour between two activity classes may go in uniform to read or study.

The use of this room will conserve student time, encourage their reading or studying habits, and clear the dressing rooms. Rooms for studying in uniform should be separate for men and women and should be located near the appropriate dressing rooms.

Workrooms

Each physical education department may wish to concentrate several work or repair functions in one or more areas according to the program and equipment and depending upon the secretarial and office needs. Two types of areas are described below. In some colleges, it may be considered practical to combine most of the functions of these two workrooms into one plan.

SECRETARIAL WORKROOM

Secretaries, machines, and typewriters are assigned to some individual offices or to a group of offices. Office supplies, typewriters, duplicating machines, and some other needed and desirable office machines can be concentrated in one or more department or college workrooms, where services can be performed for faculty members who have limited or irregular need of secretarial help. In such a room, a workroom manager can receive assignments, distribute and allocate this work, receive it from the workers, and return it to the appropriate faculty members.

The room should have sufficient area to accommodate desks, tables, and cabinets, which must be planned according to the anticipated demands. Acoustic treatment and a generous supply of electrical outlets are essential to the orderly functioning of such a service area. A wall-installed wash basin and a hand-towel cabinet are important to the economy of time in the work area.

REPAIR-AND-SERVICE WORKROOM

The need for repair and service of equipment will dictate the size of the repair-and-service workroom. Some departments will perform only minor repairs that can be accomplished in a small, modestly equipped workroom or in a part of some other area already provided. Other faculties will wish to plan to repair archery-target stands, covers, field carts, and other larger pieces that require the use of tools and space. A plan to service and repair large pieces will require space for the equipment to be repaired and tools with which to perform the needed repairs.

A well-equipped workroom will contain such features as cabinets, a sink, wood and lumber storage racks, shelves, a blower discharge fan, a work shelf, and drawers. Many, or most, of the storage areas should be locked individually or as a group with a master-key system.

RECREATION BUILDINGS

Several large universities have constructed or are considering the construction of buildings to house a wide variety of physical and social activities of a purely recreational nature. No intercollegiate sports contests are held in the buildings.

The stated objectives of campus recreation buildings are to provide on-campus leisure recreation, to develop social and ethical qualities, to develop physical and mental fitness, and to develop skills and interests for future leisure-time pursuits. The disabled should be considered in the planning of such buildings (see Part Two, Chapter 6).

Student fees support the building so that only a few special activities require a charge. Towels, lockers, and equipment are free.

A college or university union is a complex service center for members of the college community. A center of college life, this organization provides through its staff a program of cultural, social, and recreational activities as a part of the total educational program of the college. The union is considered a recreational building on campus, but it may provide services and facilities beyond those of a recreational nature.

The Association of College Unions International has classified unions by total enrollment of the college and by the type of institution (medical, technical, community, church, and so on). The nature of the building varies with each college and reflects the philosophy and traditions of the institution. Typical recreational facilities include bowling lanes, billiards rooms, game rooms, craft shops, and quiet areas.

For a complete treatise on functional planning for the construction or expansion of a college union, the reader is referred to the publications of the Association of College Unions International, which are available from Willard Straight Hall, Cornell University, Ithaca, N.Y. 14850.

Chapter 3

FACILITIES for RESEARCH

Research facilities are becoming increasingly important in colleges and universities. In the quest for new ideas and in the re-examination of old ones, research plays an important role. However, it must be remembered that the acquisition of research facilities and equipment does not guarantee that valuable research will be conducted. Facilities and equipment are only tools that must be used in an effective manner if meaningful results are to accrue. An inquiring, open-minded attitude must be maintained or the contributions from the use of research tools will be meager.

It is impossible to list the tools that any individual investigator will want to use in research. A laboratory, in a sense, takes on the personality of the one who is in charge of the research being conducted there. The mature investigator will very frequently develop his own research equipment or modify apparatus already in existence. Also, the equipment to be used determines to some extent the facilities in which it will be housed.

The very nature of investigation and investigators demands freedom to work in almost any direction. The listing of facilities and equipment tends to stifle this freedom—to stereotype the work being done. The investigator himself is the only person in a position to determine his own interests and the directions that will produce the most valuable results. Hence, only he can judge what kinds of facilities and equipment will be needed. The strength of research lies in diversity of approach.

Despite the wide diversity in research tools, there are some facilities and equipment commonly used in laboratories for research in athletics, physical education, and recreation. Following are some general considerations and some specific types of research facilities now in use or projected for the future.

GENERAL CONSIDERATIONS

Aims of the Institution

The nature of the educational institution and its objectives and function will determine in large measure the type, number, size, and relative importance of research and teaching laboratories for athletics, physical education, and recreation. In junior colleges, or in four-year institutions in which only service courses comprise the department offerings, elaborate, sophisticated research laboratories will seldom, if ever, be required. However, laboratory experience may be desirable as a part of a course, and some testing equipment may be required for use in the gymnasium or on the playing field. Furthermore, there are liberal arts colleges and other research-oriented institutions whose undergraduate curriculums require that the student have research experience. In such institutions, it is not unreasonable to provide limited research facilities and supervision of selected research activities.

In colleges and universities offering professional preparation in physical education or recreation and especially in those with graduate curriculums in these areas, there is, of course, a greater need for the development of research and teaching laboratories. Such facilities are required not only to provide experience and training for students, but also to attract and retain capable research scholars. Therefore, it is not possible to decide on a "per student" basis what kinds of laboratories or even, in many instances, how many square feet of laboratory space should be provided. The character of the institution and the interest and ability of its faculty must be taken into account before decisions are made on these matters.

Teaching and Research Laboratories

Years ago, small research laboratories served as teaching laboratories in the conduct of various undergraduate and graduate courses for professional preparation. It is still necessary and desirable to use research laboratories for presenting occasional demonstration experiments in the teaching of classes. However, this cannot be a frequent practice in a productive research laboratory, especially when the classes contain more than just a few students.

Separate teaching laboratories should be provided to handle laboratory sections of various courses. There is no reason why the same teaching laboratory cannot be utilized for conducting some of the laboratory sessions in a variety of courses, including tests and measurements, physiology of exercise, and biomechanics. At least one such teaching laboratory should be available, equipped with stationary lab tables containing gas, water, and electricity. Hoods for the Bunsen burner, cabinets for storing small pieces of equipment, and a connecting supply room are also essential. Closed-circuit television receivers are desirable. The laboratory can be designed to accommodate equipment used in conducting experiments with animals and human beings.

Frequently, the teaching laboratory can be equipped with durable, inexpensive, and easily serviced apparatus where students can carry on experiments individually or in small groups. While such equipment may not provide the degree of precision expected of sophisticated research apparatus it is generally accurate enough to present desirable principles. A space of approximately 1,000 square feet, with a 12-foot ceiling, is generally large enough to accommodate a class of 20 students.

A small gymnasium of approximately 2,000 square feet or more, with a ceiling height of 24 feet, may function as another teaching laboratory for conducting other kinds of experiments. This facility is useful for instructional purposes and for the student to gain experience in administering tests and taking measurements. Such a facility should be free of obstructions so that fitness or sport tests may be safely administered. Walls should be flat, without ornamentation or equipment, to permit wall-volley tests to be conducted. Such items as chinning bars, mats, and volleyball standards should be available for administering a wide variety of sport and other tests.

As the fields of physical education and recreation advance in maturity as disciplines, it is probable that laboratory experience will replace some of the course lectures, particularly at the graduate level. This will increase the need for teaching labs as well as research labs. Graduate students should have considerable laboratory experience before they embark on collecting data for a doctoral dissertation.

Individual Laboratories

Several forces are acting to accentuate the role of the research investigator in colleges and universities. The availability of funds, greater specialization, increased research encouragement from the administration, and competition for university faculty have all had a positive influence on the place of research. The recent interest within the fields of physical education and recreation in developing a body of knowledge and the development and expansion of graduate programs in these fields have also created a greater demand for research facilities and trained investigators.

A few years ago, there was rarely more than one faculty member in these fields engaged in research, even in large departments or schools. The picture is changing so rapidly that now a sizable proportion of some faculties are doing research sometimes several faculty members sharing a common interest or specialty. Provisions must be made for this development.

It should be recognized that often each investigator will require a laboratory or research facility for his own use, even though it may be modest in scope. Investigators who are likely to make the greatest contributions in research are, for the most part, independent thinkers and must function on their own much of the time. While investigators should be expected to share major facilities, expensive apparatus, or supporting services, each "cook" can be expected to desire at least a small "kitchen" of his own.

Joint appointments, in which a faculty member holds an appointment in more than one department, are increasing in number in the fields of physical education and recreation. Provisions should be made for some faculty members to do research in other departments, and conversely, members of other departments may be expected to use some of the physical education and recreation research facilities.

A related development is the organization in many large universities of centers or institutes for research that cut across departmental lines. There are a number of advantages to such organizational setups, including the cross-fertilization of disciplines and the sharing of elaborate facilities and expensive apparatus. In the planning of research facilities for physical education and recreation, the existing as well as the proposed institutes on the campus should be investigated.

Service Facilities to Be Shared

Although there is a need for individual research laboratories, some facilities lend themselves to shared use. A workshop supervised by a capable machinist or other skilled worker is an essential ancillary facility in institutions where considerable research is being conducted. If the research productivity of the physical education and recreation unit is sufficiently great, there is justification for housing and supporting this type of ancillary facility in this unit. If, however, research and laboratory teaching is done on a smaller scale, the facility may be shared by other units in the college or university, or such services may be purchased as needed.

If a workshop is planned, 110v and 220v electric current with good ground connections should be made available. Oversized doors should be provided as well as a good ventilation system so that sawdust and other pollutants will not become a hazard or annoyance. Cupboards with locks should be in ample supply to store hand tools to prevent their being stolen or misplaced. Since considerable noise may be generated, the workshop should be isolated from other facilities where quiet work is being done. There should be a minimum of 80 footcandles of light on the task being performed. The room should be at least 500 to 600 square feet in size, with a ceiling height of 12 feet.

Another unit that lends itself to shared use is a data-processing center. This may be a small room housing a few desk calculators available for use by various faculty members, graduate or undergraduate students, and nonacademic personnel. On the other hand, the facility may be expanded to include card punching and sorting equipment, tabulators, collators, and magnetic or punch-tape equipment. There may also be computer consoles that connect by telephone or other lines to a large centralized computer on the campus or even at other institutions. Computer consoles located in various buildings on the campus will be the most common way of providing computer services at large universities. Punch cards or tapes will not have to be transported across the campus with the use of this arrangement.

Regional electronic library services are being planned for various locations in the United States. Provisions should be made for making use of this service.

The installation of punch-card and computer equipment requires the installation of large electrical conduits, good ground connections, and oversized doors. A great deal of heat may be expected to be generated by the electronic equipment, so some means of dissipating this heat will be required. Space should be provided to permit direct access to each piece of equipment for servicing. Since considerable noise is developed when data-processing equipment is in operation, acoustic treatment of ceiling and walls is essential. The division of the area into smaller rooms with soundproof walls helps reduce the noise problem.

Other specific facilities may service a number of investigators. For example, the cost of such facilities as an environmentally controlled treadmill room, or hot or cold room, or a barometric chamber is generally so high that only one such facility may be available in one institution and thus must be shared. A photography dark room, which is an essential provision for a biomechanics laboratory, may also be needed by other scientists using a photographic recorder or by someone teaching or doing research on posture.

The dark room, for obvious reasons, should not have an outside wall with a window. Therefore, good forced ventilation is essential. The room should be provided with running water, sinks, ample wall cupboards, and a generous supply of duplex electrical outlets (110v). The recommended room size is 225 square feet or more, with a 12-foot ceiling.

A number of researchers and teachers have need for graphic services for preparing materials for publication, for presentation at meetings, and for instruction. Cameras that can produce a 3-1/4 by 4-inch slide in a matter of a minute or two at little cost should be provided. Duplicating equipment may also be housed in this facility.

If the needs of the department are sufficiently large, a full-time or part-time person may be required to prepare graphic materials. A room used for this purpose should be well-lighted—a minimum of 80 footcandles is recommended—and should have large wall cupboards for storing drafting and some camera equipment. A room with a minimum of 100 square feet and a 10-foot ceiling height will provide sufficient space for the usual requirements of this facility.

Suggestions for Purchasing Equipment

The manufacturing of research equipment has become a very competitive business. As a result, there is frequently a variety of the same kind of equipment available. Before purchasing larger expensive units, it is worth the time and effort to investigate carefully the various makes. The annual meetings of professional societies generally include exhibits by manufacturers of research equipment appropriate to the particular area of investigation.

In considering particular pieces of equipment, the following determinations should be made: (a) whether students are to use the equipment; (b) what service the company is willing to provide and where the service centers are located; (c) whether the equipment is electronically compatible with other equipment now in use or contemplated (often it is more economical to purchase units that match others from the same company so that the responsibility for servicing them rests with one company); (d) what power supply is needed; (e) ease with which the instrument may be calibrated; (f) portability of the equipment; (g) initial and annual servicing cost; and (h) noise, vibration, and heat generated by the equipment. Unbiased answers to many of these questions can sometimes best be found by having discussions with other scientists who have used such installations.

Office Space

Individual offices for the various faculty members and graduate students involved in research should be convenient to the various laboratories. The installation of one or more rooms to be used for quiet work (e.g., calculating or reading) is helpful.

Mobile Laboratory

It is a basic axiom in research that data should be collected from a representative sample of the population to which the results are ultimately to be applied. For the sake of convenience of graduate students and professors, college freshmen have become the greatest tested population of the country. However, if educators are to learn about 10-year-olds, it is generally necessary to study and test 10-year olds. It is often more convenient to take research apparatus to the schools, camps, YMCAs, and other agencies than to bring the subjects to the laboratories. Hence, in planning research facilities, serious thought should be given to the development of a mobile laboratory. The trend to eliminate laboratory schools makes the consideration of a mobile laboratory more urgent.

Trailers, campers, trucks, and other vehicles—even railroad cars—have been converted into mobile laboratories. Often the use of a field generator is necessary to provide current for operating mobile-laboratory equipment. It is surprising how much equipment can be compactly installed in a mobile facility.

SPECIFIC LABORATORY FACILITIES

The information about laboratories listed in this section comprises only suggestions of how research facilities might be organized. Obviously, the character and organization of the institution itself will be an important factor in determining how facilities are to be organized and administered. In one institution, for example, health education may be the responsibility of a School of Health, Physical Education and Recreation. In another, it may be the responsibility of the School of Public Health. In one university, exercise physiology is taught in the Department of Physical Education. In another, this responsibility rests with the Department of Physiology.

Measurement and Evaluation

Much of the so-called practical or applied research will be conducted in the gymnasium, swimming pool, and other indoor and outdoor activity areas. This means that in order to utilize measurement and evaluation equipment effectively, the regular activity areas must be planned and constructed in such a manner as to facilitate the conduct of research. For example, many skill tests are administered with the use of some type of wall volley as a part of a battery to measure skill in a certain activity. Therefore, it is important to construct the walls of a gymnasium so that present tests as well as those developed in the future may be utilized.

Consideration should be given to the attachment of special equipment to walls and ceilings, such as jump boards, ropes, and strength-measuring devices. Grids could be painted on the walls of the gymnasium as well as on the wall of a diving well in the swimming pool in order to measure distance and height when analyzing movement.

Much of the research equipment needs to be portable so that it can be moved to the action areas. This means that proper electrical outlets and suitable acoustic treatment of these areas must be planned in advance.

These laboratories will contain the equipment that will be used at the elementary, junior high, and senior high school levels. Physical education teachers at these levels should be encouraged to make use of some of this equipment on the job.

The following items of equipment are representative of the kinds used in this type of laboratory:

- RGS equipment
- Sphygmomanometer
- Stethoscope
- Sliding calipers
- Minnesota Block Test
- Tensiometer

- Audio-electronome
- Visual-electronome
- Mechanical metronome
- Chest calipers (small)
- Purdue pegboard
- Lincoln Oseretsky test kit
- Slide rules
- Stadiometer
- Automatic performance analyzer
- Hand dynamometers
- Muscle tonometer
- Back and leg dynamometer
- Electric chronometer
- A videotape recorder with playback attachment
- Skinfold calipers
- Elgin exercise table
- Stop watches (100th of a second)
- Multiple angle testing unit
- Storage cabinets (adequate for equipment, metal, 18 by 36 inches with locks).

An instructional laboratory in the elementary school should contain facilities and equipment that could be used to provide opportunities for the development of the child's body from the waist up and, at the same time, be used to measure his ability to lift his own weight, as is done in chinning or climbing. The following pieces of apparatus are suggested:

- 4 pairs of climbing ropes
- 4 pairs of climbing poles
- 4 pairs of swinging rings
- 1 wall adjustable horizontal ladder
- 1 set (3 sections) of stall bars

These pieces of apparatus will provide repeated opportunities for a class of 32 children to participate within a period of 25 to 35 minutes.

Biomechanics (Kinesiology)

There are many areas in the field of biomechanics in which research may be conducted. The type of research may range from cinematography to human engineering. If there is a physiology-of-exercise laboratory available, experimentation may take place in which the equipment from this laboratory is used either jointly with the exercise physiologist or separately by the kinesiology researcher.

In cinematographic research (especially time lapse and high speed), a room 30 by 30 feet, with a ceiling height of at least 24 feet, is a necessity. Overhead, side, and beneath grid screens are needed. Special cameras whose speeds vary from 08 to several hundred feet per second are useful. Special film readers and projectors should be provided in order that accurate measurements may be made. The use of special mirrors to reflect images is also recommended.

Equipment representative of the type used in this kind of laboratory is as follows:

- Polaroid Land camera (motor-driven)
- Bolex and Kodak reflex camera (motor-driven)
- High-speed camera (motor-driven)
- Stroboscopic equipment (including single and multiflash units with strobolume and strobotac parts)
- Graphic view camera for use with stroboscopic equipment
- Force plates
- Multichannel recorder with high-frequency response
- 35 mm reflex camera
- Videotape recorder with two channels and playback capacity
- Strain gauges and associated equipment
- Oscilloscope
- Electronic counters
- Amplifiers
- Two metal storage cabinets (approximately 18 inches deep by 36 inches wide) with locks
- Turntables
- Balometers
- Reaction measuring devices
- Taxiometers
- Sargent jump and reach boards
- Anthropometric devices
- Electromyograph facility (in addition to electrodes and a multichannel recorder with appropriate amplifiers, the room will normally have to be enclosed with copper screening or other material to eliminate electrical interference).

Special simulated game areas may be constructed so that a true picture of a performer in action may be studied. This may mean that a miniature running track is developed, as well as other similar replicas of playing areas. Nets and other devices may need to be used to catch objects or to prevent them from traversing the customary distance.

Physiology of Exercise

In planning facilities for research in the area of physiology of exercise, it is well to anticipate that research with animals as well as with human beings may be conducted. Although most of the interest of physical educators is in applied research in which human subjects can be used, much valuable work can be done inexpensively with dogs and smaller animals. Equipment is available for exercising many kinds of animals. The effects of either forced or spontaneous exercise may be studied. Some suggestions for facilities in this area are given below.

EXERCISE ROOM (HUMAN BEINGS)

An area of at least 40 by 40 feet, providing a minimum of 1,600 square feet of space, should be provided for the exercise room for human beings.

The most popular methods of standardizing exercise in human beings are (a) by means of a motor-driven treadmill, bicycle, or other ergometer; and (b) step tests of various kinds. The exercise room should be large enough to accommodate all of the needed equipment. There should be space for five technicians as well as for scientific instruments (e.g., a Tissot tank).

Since some noise and vibration result when the treadmill is operating—and some treadmills are quite heavy—it is well to locate this room on the ground floor, with provisions for reducing noise. The treadmill should be installed in a pit (and even on a pad to help further reduce noise), if possible, with space in the pit for servicing.

The room should be air-conditioned, with control over temperature within a ±1-1/2 degrees Fahrenheit and control over humidity of ±5 percent. Electric current (110v and 220v) should be supplied through numerous outlets. A large thermopane observation window should also be installed.

A room 20 by 25 feet with a ceiling height of 12 feet—to allow for walking, running, or riding a bicycle up a grade on the treadmill—is generally sufficient. If the treadmill is not installed in a pit, the ceiling may have to be higher. It is usually desirable to have connecting cables, including voice communication, to space adjoining the exercise room so that desirable data can be recorded outside the room. The kinds of equipment found in the exercise room, in addition to exercising apparatus, might include the following:

- Multichannel paper recorder
- Tape recorder (multichannel)
- Gas meters
- Cot
- Telemetering apparatus
- Electronic gas analyzers
- Douglas or meteorological bags
- Barometer.

ANALYTICAL ROOMS

The number of analytical rooms will depend upon the extent of the research being conducted and the number of investigators involved. These rooms should each be a minimum of 20 by 20 feet, with a ceiling height of 10 feet. They should be air-conditioned and contain the benches, cabinets, sinks, fume hoods, and air, gas, and electrical-current supplies usually found in laboratories of this type. The typical kinds of equipment used in these rooms include the following:

- Chemical gas analyzer
- pH meter
- Analytical balance
- Still
- Spectrophotometer
- Refrigerator or freezer
- Centrifuge
- Microscope
- Autoclave
- Glassware
- Bunsen burner
- Desk calculator.

ANIMAL EXERCISE ROOM

This room should be similar to the exercise room for human beings except that it may be smaller 300 to 350 square feet, with a 10-foot ceiling. Treadmills for exercising dogs or smaller animals are no larger than half the size of human treadmills. Ventilation should be adequate to minimize odors and to discharge air. This air should not be permitted to circulate to other rooms. Terrazzo or other suitable floor surface, with ample drains to facilitate cleaning, should be provided. The equipment to be used should be similar to that found in the exercise room for human subjects.

ANIMAL HOUSING ROOMS

Cages for small animals should be in racks on casters to facilitate their transfer to a steam room. The steam room for cleaning cages should be on the same level and as close as possible to the housing room. The animal rooms should all have adequate ventilation to minimize odors, and the air should not be recirculated to other areas. The rooms should be air-conditioned and without natural light. Lights should be vaporproof, and automatic light control should be available. The electric current supply to this room, as well as to refrigerators and freezers, should be connected to an alarm at the plant department so that it will be known immediately if a power failure occurs. An automatic recorder for continuous recording of temperature and humidity should be installed. Terrazzo or other suitable floor surface with adequate mudcrock drains should be provided. All surfaces should be glazed, and there should be a sill cock for hosing down the room. Only food, water, cleaning supplies, a scale, and a few other pieces of equipment are normally kept in the animal housing room.

ADDITIONAL FACILITIES

In many departments, additional major facilities may be required. Because research in exercise physiology is closely related to research in environmental physiology and nutrition, the following facilities may be needed:

- Barometric chamber (with space for controlled exercise)
- Hot room (with space for controlled exercise)
- Cold room (with space for controlled exercise)
- Diet kitchen
- Flow-through water tank for studying energy metabolism during swimming and rowing
- Isotope storage, handling, and counting equipment.

Motor Learning and Psychology of Sports

Much of the research equipment found in psychology, physiology of exercise, and kinesiology (biomechanics) laboratories can be utilized in conducting research in motor learning and psychology of sports. However, it is necessary to have a separate room or facility, at least 30 by 30 feet, with a 12-foot ceiling.

The arrangement of the equipment in the room will depend on the research under way at the moment. In any event, the electrical devices that are used should not be constantly moved or they will become unusable.

Some of the equipment that might be included in a laboratory for research in motor learning and psychology of sports is as follows:

- Multichannel recorders
- Standard electric clocks
- Interval timer
- Steadiness units
- Muscle stimulator
- Electronic counters
- Variable power supply
- Voltage stabilizer
- Battery charger
- Seashore test
- Electronic kits
- Audio amplifiers
- Microphone
- Audio oscillator
- Oscilloscope
- Telemetry transmitter
- Telemetry receiver
- Magnetic tape recorder
- Storage cabinets (metal, with locks).

RESEARCH AND TEACHING LABORATORIES

Safety Education

Many institutions have special facilities for research in safety education. Some recommended facilities and equipment items are as follows:

- Simulator laboratory (600 square feet)
    - Aetna Drivotrainer
    - AAA auto trainer
    - Driver trainer
- Psychophysical testing laboratory (720 square feet) for testing visual acuity, distance judgment, field of vision, color vision, night vision, glare vision, glare recovery, reaction time, steadiness.
- Safety Education Laboratory (500 square feet)

  Equipment for testing Protective devices for industrial accident prevention, protective devices for use in physical education, athletics, and recreation.

  Multiple-car off-street driving range (at least 350 by 450 feet; Part Two, Chapter 2, Figure 00).

Recreation

The research facilities of other disciplines, such as those of psychology and sociology, should be made available for use by recreation department personnel. However, it is recommended that a special camp site, where experimentation with human subjects may be conducted, be developed by the college or university. Studies of plant life and soil conditions may also be made at such camp facilities.

Computer facilities should be utilized by the graduate students and faculty of the recreation department. Therapeutic recreation researchers should use the research facilities of medical schools as well as those of state and local hospitals. The establishment of model community centers and playgrounds on the campus could provide ideal settings for research being conducted on leadership and program problems.

History and Sociology of Sports

Little in the way of special facilities is recommended for research in the history and sociology of sports. In addition to office space, research workers in this area might require rooms for the storage and use of manuscripts, rare books, tapes, and videotape collections. Reproducing equipment and microcard or microfilm readers might also be needed.

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Chapter 4

FACILITIES for FACULTY and STAFF

ADMINISTRATIVE UNITS

When planning facilities for physical education, recreation, and athletics, careful consideration should be given to the administrative functions pertinent to the conduct of these programs. Well-planned and effectively designed office suites and work rooms facilitate a smooth working relationship among the various divisions and enhance the success of the program. Staff members develop increased morale and motivation, which foster increased productivity, when office spaces and service areas provide a pleasant environment and a functional setting in which to work.

The layout of administrative units varies according to the program needs of the respective school or college. Planners can generalize about the relationship of the various spaces, but the unique problems of individual schools make it difficult to establish hard rules. Planners should consider the following guidelines in relation to the special needs of the individual institution.

Centralization of faculty offices normally improves communication among the various departments. Working as a unifying group develops a valuable esprit de corps among faculty members. On the other hand, segregation tends to break down unity among groups. In larger colleges, the trend has been for athletic coaches and administration to locate apart from physical education. Since the athletic program is expansive, the separation allows for efficient athletic administration independent of physical education. However, over a period of time, with separation of personnel and subsequent changes in staff, a communication gap develops and little interaction takes place between two segments that normally require close coordination.

Planning committees need to weigh carefully the factors affecting administration prior to decentralizing a staff. At the same time, there are divisions that can function more efficiently if the staff is housed as a unit in a favorable location. It is recommended that staff members be grouped as working units according to their function but retain a close proximity to other departmental personnel. Normally, the following units might comprise efficient working units:

Athletics
Intramurals
Teacher Education
Graduate Studies
Basic Instructional Program.

The trend is for basic institutional programs for men and women to merge into a single administrative unit. New and better coeducational programs are encouraged when the responsible individuals can discuss problems frequently. The location of facilities and congestion caused by large numbers of participating students bears heavily on the location of this area. Basic instructional programs involve the greatest number of staff and students and should be so located as not to interfere with other facets of administration.

ESSENTIAL ADMINISTRATIVE FACILITIES

Essential facilities related to administration include administrative and faculty offices, secretarial and clerical offices and workrooms, reception and waiting room, athletic offices, storage rooms, and faculty/staff shower and rest rooms.

Administrative Offices

Administrative offices should be located centrally in the building, with easy access from main entrances but apart from the noise and the main traffic flow. A reception area, controlled by secretarial assistants, should be available for guests and for scheduled appointments.

The administrator's office should have a minimum of 200 square feet. A large facility may contain a suite of offices for several administrators. These offices should be located close to the secretarial area but secluded from the normal routine of the day. Administrative offices should be provided with private toilet rooms.

The decor should produce pleasant working conditions and present a favorable impression upon visitors and guests. Consideration should be given to acoustics, including the transmission of sound through the walls and the sounds resulting from heating and cooling units. Carpeting and drapes are assets in these offices for improved acoustics, aesthetics, and morale.

Faculty Offices

Faculty offices should allow the staff to work comfortably. Particularly at the college level, many staff hours are spent in the office on tasks associated with teaching. Writing, planning, counseling, and routine administrative work are important facets of the job. In order to be productive in these duties, the staff member must be able to function under pleasant working conditions.

Office spaces should be large enough to accommodate the following items:

Large work desk with lock
Comfortable desk chair
Filing cabinet
Bookshelves
Side chair
Compact storage cabinet.

The private office is recommended and should be a minimum of 100 square feet. If rooms are larger, a common practice is for a second person to be assigned to the office when additional staff is hired. The opportunity for each individual to work with maximum efficiency is thereby reduced.

Air-conditioning is recommended in warm climates if a summer program is conducted. Careful thought should be given to the location and arrangement of doors, windows, telephone, electrical outlets, intercommunication facilities, storage areas, lighting, heating, and ventilation.

Secretarial and Clerical Offices

Planning for secretarial and clerical offices should include a job analysis for each position. Normally, secretaries are expected to perform, in varying degrees, the following duties:

- Act as receptionist for students, faculty, visitors, salesmen, press representatives, and others
- Take and transcribe dictation, and perform a variety of typing chores
- Receive and redirect telephone calls
- Receive and distribute mail and other communications
- Answer written correspondence
- Schedule appointments and keep track of faculty
- Operate a variety of office machines, such as duplicators, mimeograph machines, ditto machines, and computers
- File department papers, correspondence, forms, and other materials
- Perform such business operations as bookkeeping and accounting
- Prepare copies of class tests and other teaching materials as needed in courses
- Dispense tickets for spectator events.

In small schools requiring one or two secretaries, a single main office usually suffices for all the tasks. At universities conducting extensive programs in physical education, recreation, and athletics it is preferred that secretaries be dispersed to various areas according to their functions.

Secretaries should be located in accessible areas, but in such a position that individuals do not pass in the immediate vicinity of the area unless business is to be conducted. Socializing with students must be discouraged.

If the reception room office arrangement is used, the reception responsibilities often make it impossible to carry out the important tasks. Under this arrangement, if more than a single secretary is located in the office, it is best to use a system whereby a visual barrier will isolate those secretaries not serving as receptionists.

For each secretary, an operating space of at least 120 square feet should be planned exclusive of the reception and storage areas. Filing cabinets, desks, storage cabinets, typewriter space, and a work counter are the requisites for each secretary.

The telephone system should be convenient for all. The main telephone containing all extension and intercom lines should be at the receptionist's desk.

Easily accessible individual mailboxes should be located in the office. It is important that messages be readily seen and normal security be established for the mail.

A work room for carrying out routine clerical duties must be available. It contains the ditto machine, mimeograph, and copying machines with ample counter space to work efficiently. Metal shelving for paper and mimeograph supplies is required. Equipment for retaining and filing stencils should be placed in this room. If the work space for calculators and other office machines is not available in the main office, the work room should be used for this purpose. Rather than duplicate the purchase of costly machines, secretaries from various units, even though not located together, might use the same work room. The room should therefore be so located as to be accessible to the secretarial staffs of a number of units.

Audiovisual Storage

Audiovisual equipment represents a large capital outlay and is subject to damage and theft if proper security is not provided. Videotape with instant playback, movie projectors, strip films, record players, and cameras are common equipment items. Additional supplies such as films, tapes, spare parts, and cords must be properly stored and inventoried.

It is recommended that secure storage areas be planned at the respective teaching stations for equipment normally used at that site. Such an arrangement encourages use of the teaching aids and reduces preparation time. However, in addition to these satellite areas, it is necessary to have a main audiovisual storage room with a good inventory and issue system and with one person responsible for security.

Schools expecting to use videotape and replay equipment need to establish several small areas in which staff and students may view and evaluate tapes or review tapes for preparation purposes. If normal classrooms are not available, a special room should allow several students to view tapes simultaneously. Methods teachers, student-teacher supervisors, and skill instructors have the most need for viewing films and should be consulted concerning needs.

Conference Room

A conference room should be included in the plans for a modern physical education plant to serve athletics, physical education, and recreation. There is frequent need for interdepartmental administrative and staff meetings. Student oral examinations and small-group discussions are best carried out in a room designated for these purposes.

A large table with adequate seating situated in a well-ventilated, attractive room is recommended. A closet area is convenient for visitors and guests. Usually, a small table for refreshments is provided. Consideration should be given to a kitchenette. Depending upon the needs of the particular school, the room can serve such other purposes as staff lounge, reading room, film viewing area, and so on.

Chapter 5

FACILITIES for LOCKERS and SHOWERS

The locker and shower room area together with the other related general service facilities represent the nucleus of the physical education complex The entire physical education and athletic staff must participate in the development of educational specifications and the review of preliminary architectural drawings to ensure maximum efficiency and economy of space. Architectural planning must include in addition to the total activities of physical education and athletics, consideration of programs anticipated for the future. Foresight in the early planning is economical relative to space allocations, efficiency of movement, and functional future building additions. Locker and shower rooms must be considered for physical education, athletics, faculty, visiting teams, staff, officials, and professional major students.

THE DRESSING LOCKER ROOM

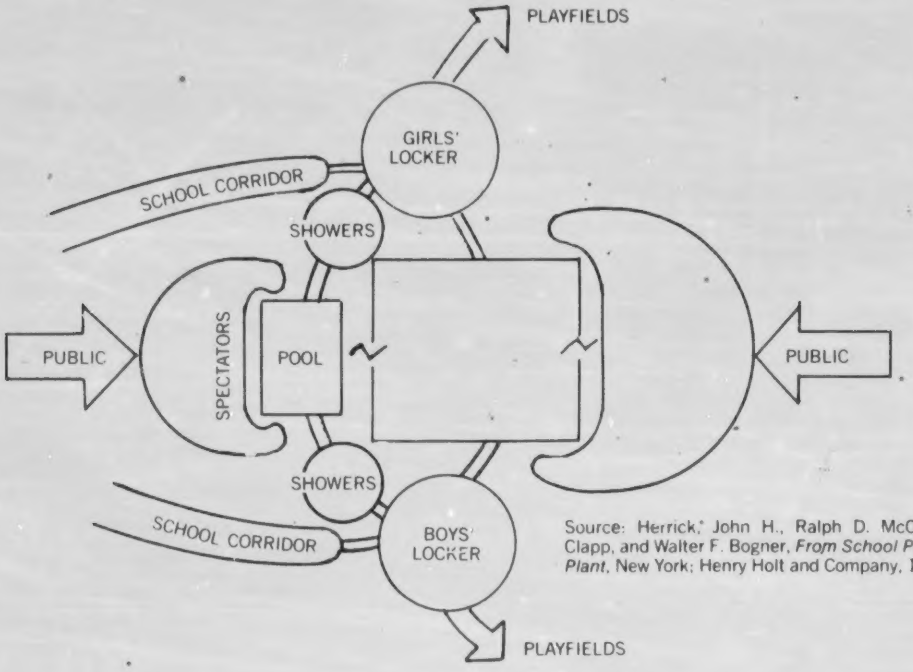
Location

The location of the main dressing locker room is a vital consideration in facility planning, since it serves as the nerve center for all activity spaces. A functionally designed floor plan will control traffic flow and allow for maximum efficiency for staff and students.

Perhaps the most important aspect of location is accessibility. The locker room should be located to serve the indoor and outdoor teaching stations and other service facilities requiring dressing space. The dressing room should be immediately accessible from corridors. Planning for several corridors leading to these areas will reduce overcrowding during class changes. (See Figure 1.)

Ideally, the dressing room should be on the same floor as the gymnasium and the swimming pool when a common level is used for both stations to alleviate traffic congestion and possible injuries resulting from movement up and down stairways. (See Figure 2.) Local architectural problems may make this location impractical in some instances.

The dressing room should have direct access to outdoor recreational areas and indoor stations without requiring individuals to cross main corridors. As students return from outside activities they should have access to an area equipped



Source: Herrick, John H., Ralph D. McCleary, Wilfred E. Clapp, and Walter F. Bogner, *From School Program to School Plant*, New York; Henry Holt and Company, 1956, p. 325.

Figure 1. Space Relationships in the Physical Education Suite.

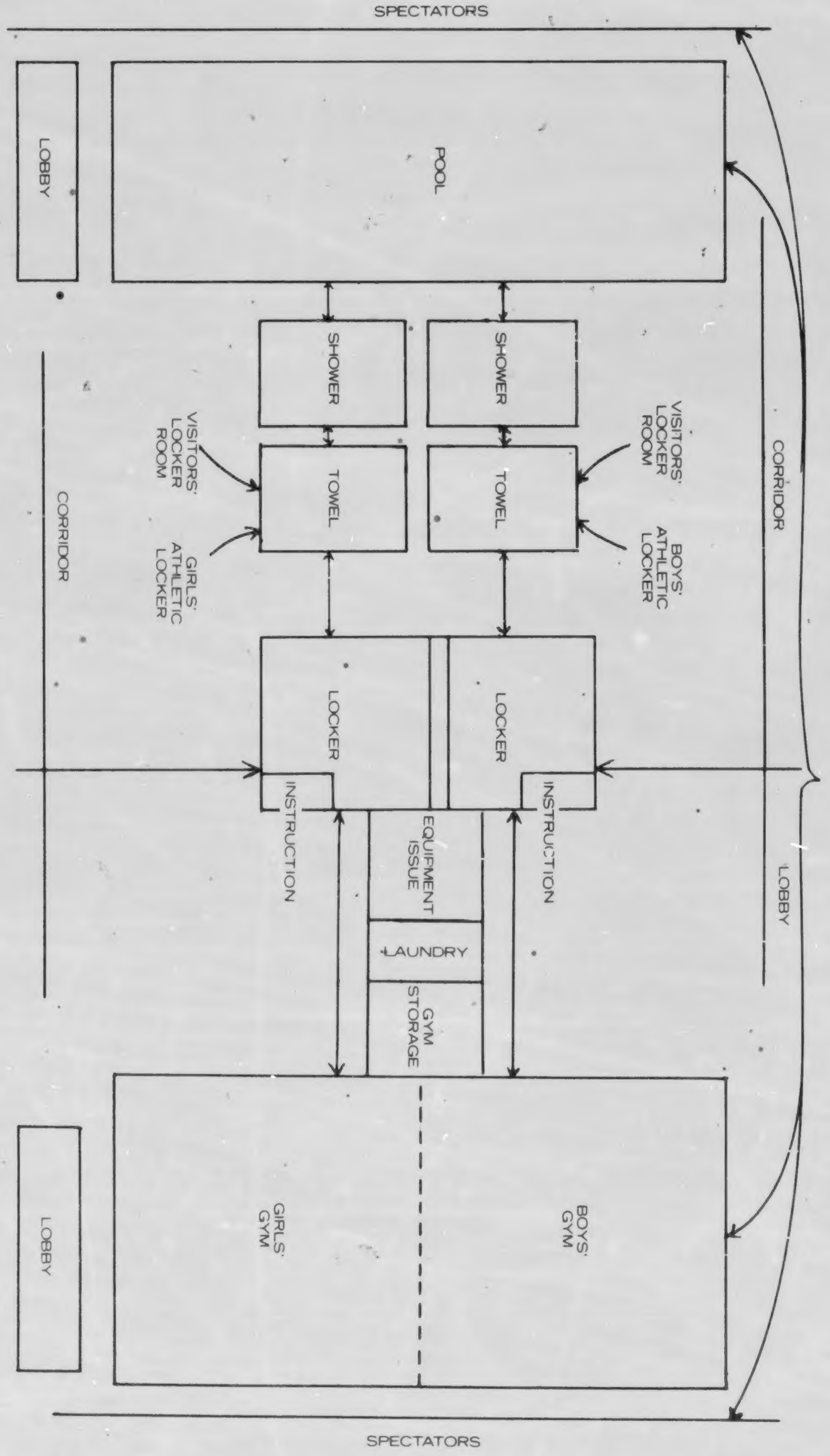

SPECTATORS
LOBBY
POOL
SHOWER
SHOWER
VISITORS' LOCKER ROOM
VISITORS' LOCKER ROOM
TOWEL
TOWEL
GIRLS' ATHLETIC LOCKER
BOYS' ATHLETIC LOCKER
CORRIDOR
CORRIDOR
LOCKER
LOCKER
INSTRUCTION
INSTRUCTION
EQUIPMENT ISSUE
LAUNDRY
GYM STORAGE
LOBBY
TO BOYS' PLAY FIELDS
LOBBY
GIRLS' GYM
BOYS' GYM
SPECTATORS

Figure 2. Location of Lockers and Showers.

with special drains and a mud crock for cleaning purposes. When the swimming pool adjoins the locker room, participants should be required to pass from the dressing area through the shower to the pool to ensure cleanliness (see Figure 3). In some designs it is desirable that a separate dressing room be located at the pool area. This is particularly true if a pool is used extensively by community and after-hours groups.

Other considerations for dressing locker room location are in relation to shower, toilet facilities, equipment issue rooms, and instructors' offices.

Size

The size of the dressing locker room is based on a number of considerations. The locker system and the method of distributing towels, uniforms, and equipment affect size demands. Of particular importance is the number of students using the area at peak load. If there is an overlap of classes or simultaneous use by athletics and physical education the room must be large enough to meet these accommodations without confusion. A general rule of thumb recommends a minimum of 20 square feet per person. A carefully drawn, preliminary scaled plan to include the locker placement, visual barriers, and accessories is the only acceptable way to ensure sufficient space allocation. Additional space should be allowed if faculty, graduate assistants, and intramural, athletic, and sport clubs must also use this facility.

Physical Features

DOORS

Placement of doors for dressing rooms should facilitate a smooth traffic flow. In locker rooms that have many participants arriving and departing simultaneously, it is wise to provide for an entrance and a separate exit to a common passageway in order to eliminate a hazardous condition. All doors should be of heavy-duty, moisture-resistant material and should open to form a natural sight barrier. Doors should be placed in such a position as to offer protection to individuals who move through a main adjoining corridor. Outside doors from the locker room should be equipped with panic bars of noncorrosive metal.

WALLS

Walls should be of a moisture-resistant material, easy to clean, and finished in a pleasing, light color. All corners in locker rooms should be rounded, and the junction of the wall to the floor should be covered for ease of cleaning and prevention of injuries. Normally, tile is preferred because it is durable and easy to clean.

FLOORS

Floors should be of nonskid, impervious materials with a carborundum impregnated surface such as ceramic or quarry tile. Concrete floors with nonskid surfaces should be treated with a hardener to prevent penetration of moisture and odors. Terrazzo, while offering excellent hygienic advantages, is too slippery for the average locker room. The same holds true for vinyl or asphalt tile.

Floors should be sufficiently sloped toward dressing room drains. Hose bibbs, located near the floor and recessed, should be provided for easy cleaning of floors.

Synthetic carpeting, laid directly over concrete, is becoming very popular for selected locker room use. It is highly attractive and aesthetically pleasing. It affords excellent footing and reduces noise to a minimum. Another advantage is that the floor need not be sloped since the floor is not hosed down for cleaning. Repairs can be made easily. The maintenance cost for carpeting is greater than for other floors since regular vacuuming and periodic shampooing are required. However, in well-supervised areas, the carpeted locker room offers unique advantages.

Locker bases, 8 inches high, should be of the same material as the floor and coved at the base.

CEILINGS AND LIGHTS

The ceilings, of a light color, should be acoustically treated with a material impervious to moisture.

The lights should have vaporproof fixtures and be centered directly over the locker aisles for maximum efficiency. (See

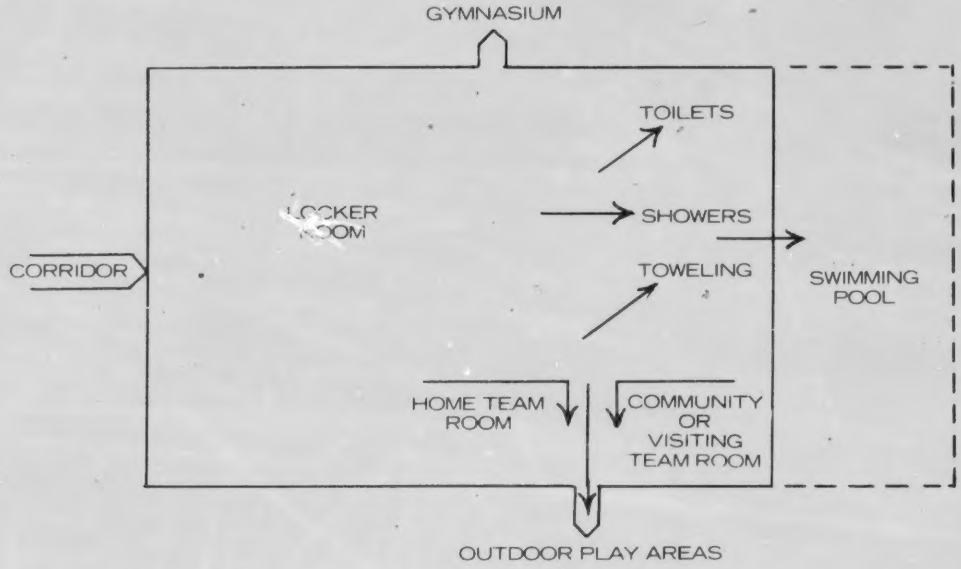


Figure 3. Suggested Traffic Flow Chart for Locker Rooms, Shower, and Pool.

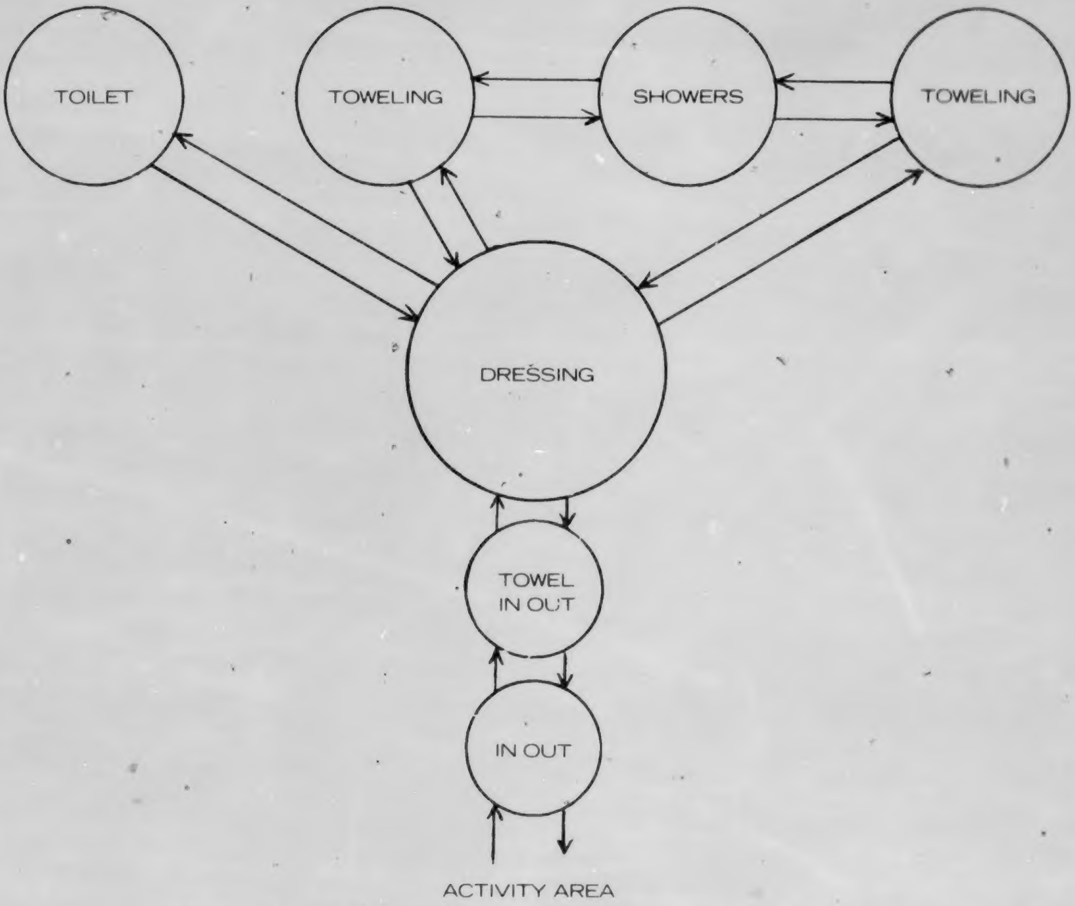


Figure 4. Locker-Suite Traffic Flow.

Part Two, Chapter 7 for lighting specifications.) Electric outlets—including three-prong units—should be approximately three feet above floor level. Emergency lighting should be available at all times.

Sidewall windows should be no larger than 24 inches in height, with the lowest point of the window at a maximum of 36 inches from the ceiling. This design provides maximum privacy and allows the lower portion of the walls to be used for other services or an additional bank of lockers. If windows are designed to operate for opening and closing, they should be maintained regularly and controlled easily from the floor. In most instances, the ventilation system should be effective enough to eliminate the necessity of opening and closing windows. Windows of frosted, translucent material should be used to allow natural lighting to pass down locker aisles rather than against a bank of lockers. Placement and size of windows should be planned in conjunction with the entire locker arrangement and should not dictate or limit locker placement.

Vented sky domes serve as an effective source of natural light. Although sky domes have been a source of constant leaks, new construction has reduced the hazards.

ACCESSORIES

Mirrors should be placed at strategic locations in the dressing room and vanity areas. Several full-length mirrors, placed at least 12 inches from the floor, should be available for individuals as they depart the room.

Drinking fountains of stainless steel or noncorrosive material should be located near traffic flow. They should be recessed or placed to protect the user from traffic movement.

Lack of hair drying facilities often discourages maximum physical education participation, particularly when inadequate time is provided to meet schedule commitments. Current hair styles make such facilities as necessary for men as for women. Wall blowers—preferably with separate hoods, mounted at varying heights, and spaced at three to four foot intervals—are recommended. If the dressing room services are used by swimmers, one dryer for four or five men is sufficient. A ratio of 1 to 3 is needed for women.

COLOR

Adequate attention should be given to planning a total color scheme for the dressing facility. Locker rooms no longer need to be planned with an antiseptic appearance. A variety of colors on lockers, according to the locker system used, coordinated with decorated walls and carpeting, creates a pleasing environment. Renovation or new construction should plan for the use of color to improve locker room aesthetics.

SUPERVISION

In public institutions, supervision is of constant concern. Strategic placement of offices or service areas can facilitate administrative control.

The office of the teaching personnel might be located in an adjunct sector of the locker room. Direct access to the locker room from the office will conserve movement in the performance of routine chores and conveniently allow for consistent surveillance. An advantage of locating teachers and working personnel near the dressing room is that it makes supervision an ongoing rather than piecemeal process. Frequently, a glass partition or side windows on the wall facing the locker room provide adequate sight for supervision. The office floor is sometimes elevated to improve sight lines.

Another source of supervision is provided by placement of the equipment-issue room or towel distribution center in a location that allows working personnel to observe activity in the room. Placement of lockers should be perpendicular to the supervisory staff spaces for ease in observing locker aisles.

SHOWER ROOMS

Location

Shower rooms should be centrally located in relation to the dressing rooms they serve (see Figure 1). It is economical to provide a shower room that can service more than one area; however, it must be of adequate size to accommodate peak loads in all areas. The nature of the groups using the facility is an important consideration; for example, if a swimming pool will be used extensively by community groups, it may be advisable to build separate service facilities for the pool. Such exclusive facilities offer greater flexibility of programs along with improved supervision and security.

In general, lavatory, toilet, and shower facilities should be grouped in close proximity. Cost of installation is reduced since the amount of piping will be considerably lessened.

Size

The size of the shower room is determined by the type of

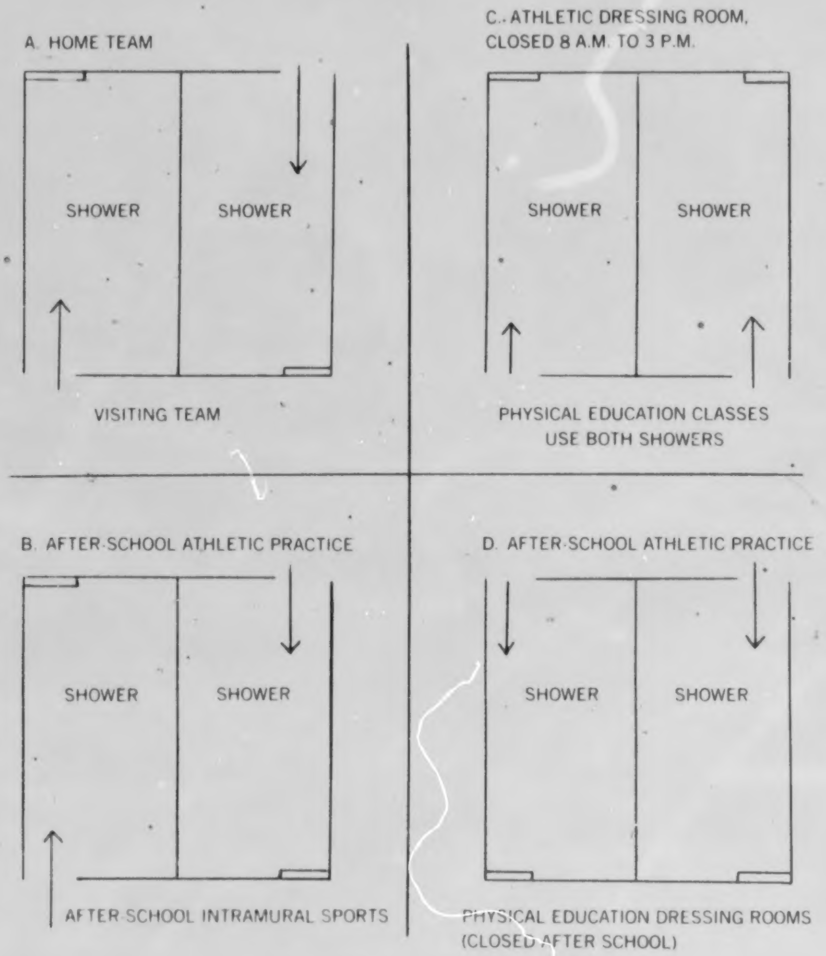

A. HOME TEAM
SHOWER
SHOWER
VISITING TEAM
C. ATHLETIC DRESSING ROOM, CLOSED 8 A.M. TO 3 P.M.
SHOWER
SHOWER
PHYSICAL EDUCATION CLASSES USE BOTH SHOWERS
B. AFTER-SCHOOL ATHLETIC PRACTICE
SHOWER
SHOWER
AFTER-SCHOOL INTRAMURAL SPORTS
D. AFTER-SCHOOL ATHLETIC PRACTICE
SHOWER
SHOWER
PHYSICAL EDUCATION DRESSING ROOMS (CLOSED AFTER SCHOOL)

Figure 5. Methods of Using Flexible Shower Rooms.

shower arrangement and the number of people served at peak time. It is important that all individuals participating in physical education classes, intramurals, and athletic programs have the opportunity to take showers (see Figure 5). Since time for showers is usually limited to 10 or 12 minutes, a sufficient number of shower heads must be planned. Ten shower heads are recommended for the first 30 people, and an additional shower head is recommended for every four persons thereafter.

All types of shower installations should be examined and the selection made according to the advantages of a particular system for the situation at the individual institution (see Figure 5). The center post system provides for a grouping of shower heads on a single pole. This arrangement allows for the use of shower barriers rather than solid walls around the room and thus affords easy supervision. If this system is selected, the hardware and piping attached to the post at the base should be of a noncorrosive material and a maximum of four shower heads per post should be used.

Installations along the outside walls are the most economical in terms of space, since at least three full walls can be used for shower heads. It is absolutely necessary that provision be made to repair plumbing defects, usually by putting plumbing in pipe spaces and providing access from the back of the shower wall.

Overhead installations are adequate for showering before swimming. However, the advent of longer hair styles makes this system unpopular except for swimming pools.

The progressive walk-through shower is often used for showering before swimming. It has limited advantages, however, because without close supervision it does not ensure proper cleansing.

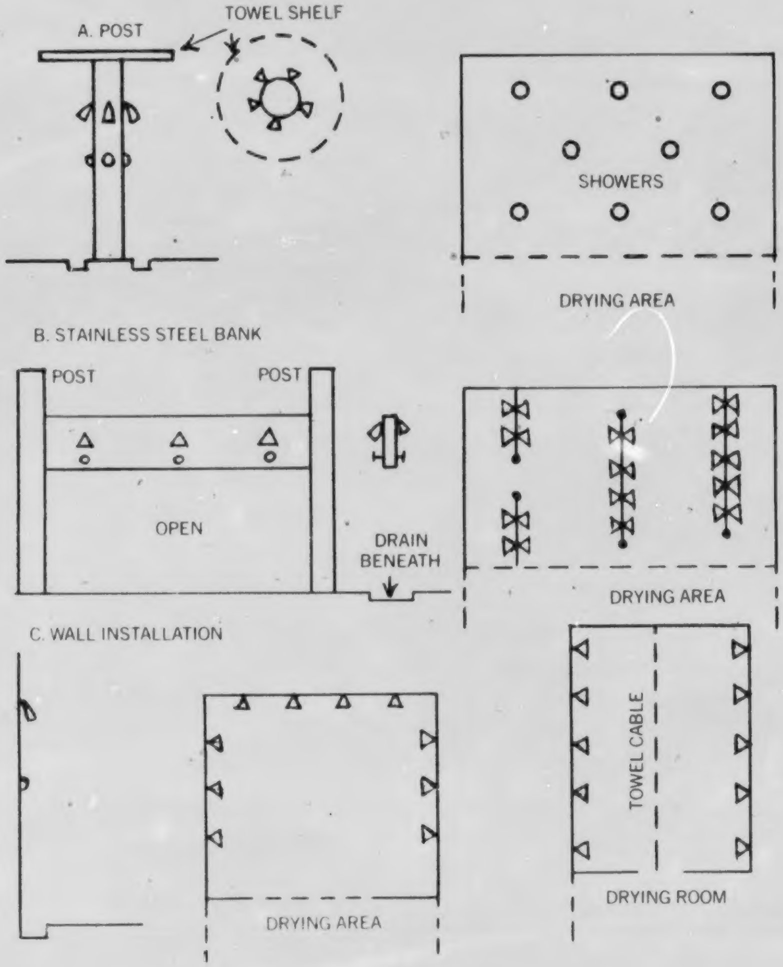


Figure 6. Shower Head Arrangements.

TABLE 1

HEIGHTS OF SHOWER HEADS AND MIRRORS*

Age Group	Grades	Mirror Height		Shower Height		Shower Valve Height
		Vertical Length	To Bottom of Mirror	Girls	Boys	
Elementary	2 thru 6	30″	32″	50″	55″	36″
Junior High	7 thru 9	30″	40″	54″	60″	40″
Senior High	10 thru 12	30″	44″	56″	66″	45″
Adults		30″	48″	60″	72″	48″

*Notes:
1. Mirror mounting heights apply only to mirrors of size listed. Smaller mirrors are not recommended.
2. Shower heights are for heads 8″ from wall. Height should be adjusted if closer to wall.
3. Girls shower heights are shoulder high.
4. Shower heights are from floor to face of shower head (not rough-in dimension).

Physical Features*

SHOWER HEADS

The shower head is an important consideration. It should be selected after inspecting a number of features. The head should be self-cleaning and allow for adjusting fineness of spray. It is generally recommended that, when installed in buildings of institutional use, the angle of spray should not be adjustable. Spacing between shower heads should be two and one-half to three feet if used exclusively for high schools and three to three and one-half feet for college. The height of the shower head should allow the spray to be directed at shoulder height, making it possible to keep the hair relatively dry if desired. Most shower rooms are used by various age groups in community programs, and it may be desirable to vary the height of a few of the shower heads. A master temperature control should prevent excessive water temperatures. Each shower head should have an individual control consisting of one hand control rather than separate hot and cold water controls.

Gang showers are most suitable for men. At least 10 percent of the shower heads for women should be of individual booths close to the toweling room.

A liquid soap dispensing system with adequate outlets should be designed so that all piping is behind the shower room walls. This system should allow the custodial staff to refill the reservoir at a source away from the wet area. Recessed soap dishes are recommended since many individuals prefer to use a particular bar soap or shampoo. Consideration must be given to the dangers of soap bars on wet floors and glass shampoo bottles.

DOORS

The opening to the shower room should be as wide as possible to allow freedom of movement in both directions. Openness facilitates supervision, and many shower rooms are being built with half walls or splash barriers for this purpose. A low curbing of a nonslippery top surface may separate the shower and dressing room depending upon the locker room drainage system.

WALLS

The shower room walls should consist of a smooth and impervious material that can be cleaned easily. Builders should consider the use of glazed building blocks for the walls of these areas. Glazed block construction provides a surface similar to tile but less expensive to install. It may be used in nonbearing walls only. Glazed block is suitable for low splash walls or dividers.

CEILINGS

Ceilings should be moisture-resistant, acoustically treated, and a minimum of nine feet in height. All lights should be recessed and vapor-proof, with switches located in dry areas. It is desirable that the lights be operable from the attendant's office area.

FLOOR

Nonskid, ceramic tile or equivalent should be used as the floor surface. The floor should be pitched away from the dressing room area and toward adequate drains. The most desirable drainage system for shower rooms consists of tiled gutters directly beneath the shower heads leading to appropriately spaced drains covered with a removable grading of nonferrous metal. All gutter edges and floor and wall joints should be coved.

Hose bibbs, for cleaning purposes, should be located outside the shower room for safety reasons.

VENTILATION

A ventilation system is more economical and efficient if the shower room is located with at least one wall to the outside, allowing for complete ventilation and humidity control. It is essential to eliminate condensation, or maintenance becomes an expensive item.

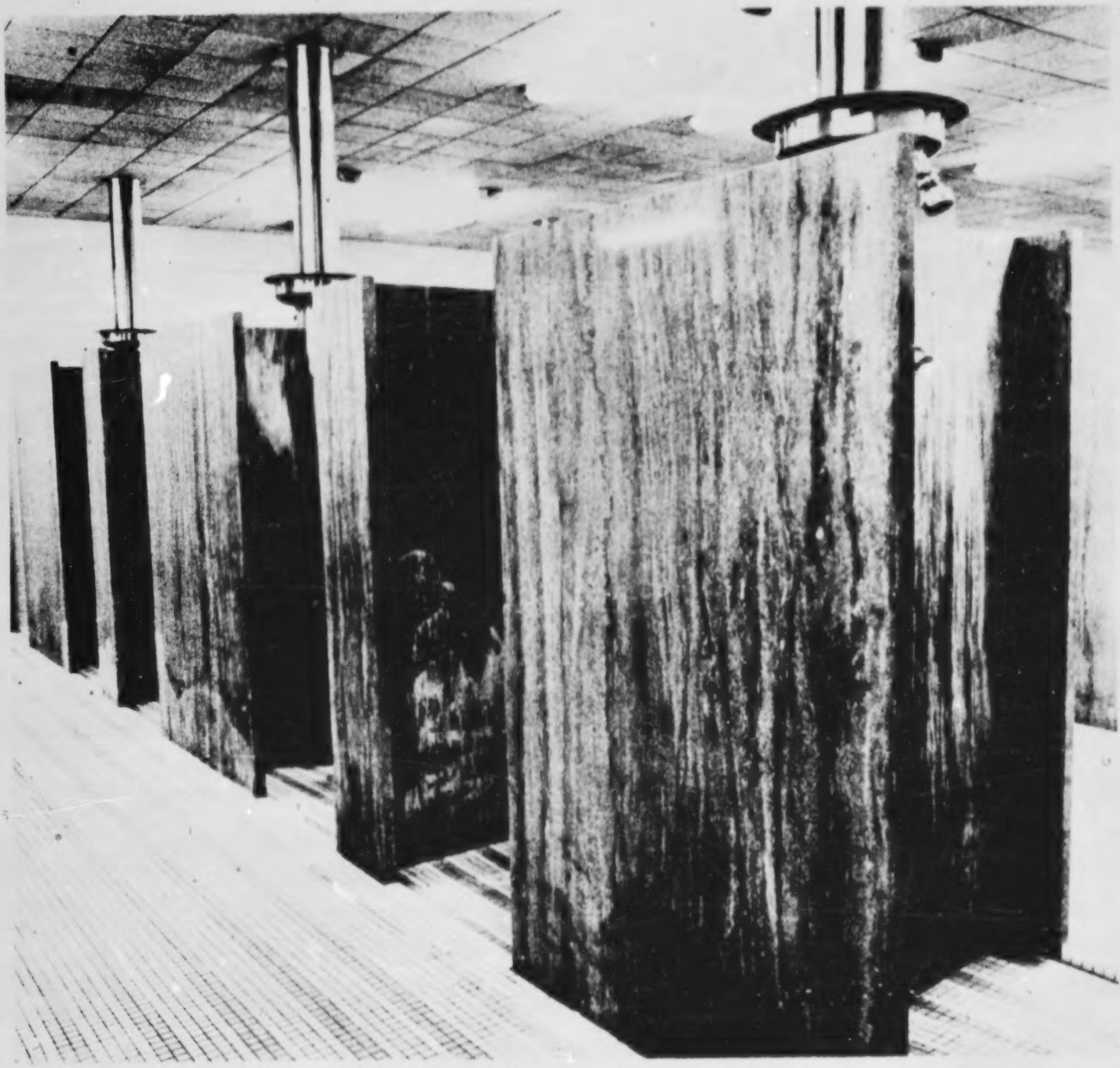
TOWELING ROOM

Proper planning of the drying or toweling room can do much to ensure its proper use. In general, its size should be comparable to the shower room, in order to encourage complete drying in this area. This is particularly important when carpeting is planned for the dressing room.

The toweling room should be immediately accessible to the shower and dressing rooms (see Figure 7). The walls, floor, and ceiling should be of the same material and quality as the shower room. Floor edges should be coved. Normally, the walls need not be tiled beyond seven feet in height. (However, in most construction it may be more economical in the long run to tile to the ceiling.) Noncorrosive towel bars should be attached approximately four feet from the floor. It is convenient to have the towel-issue room adjacent to, or near, the drying room.

Several foot-drying ledges, approximately 18 inches high by 12 inches wide and constructed of the same material as the floor and walls, should be available in remote locations. They should be coved at the base and bull-nosed at the top.

*Portions of this section are adapted from the following: American Association for Health, Physical Education, and Recreation, *Dressing Rooms and Related Service Facilities*. Washington, D.C.: the Association, 1972.



University of Utah Women's Shower Facilities.

For sanitary and safety reasons, benches should not be installed in the toweling area.

Provisions should be made for drainage. A bull-nosed, nonskid curb should separate the drying room from the locker room to protect against flooding.

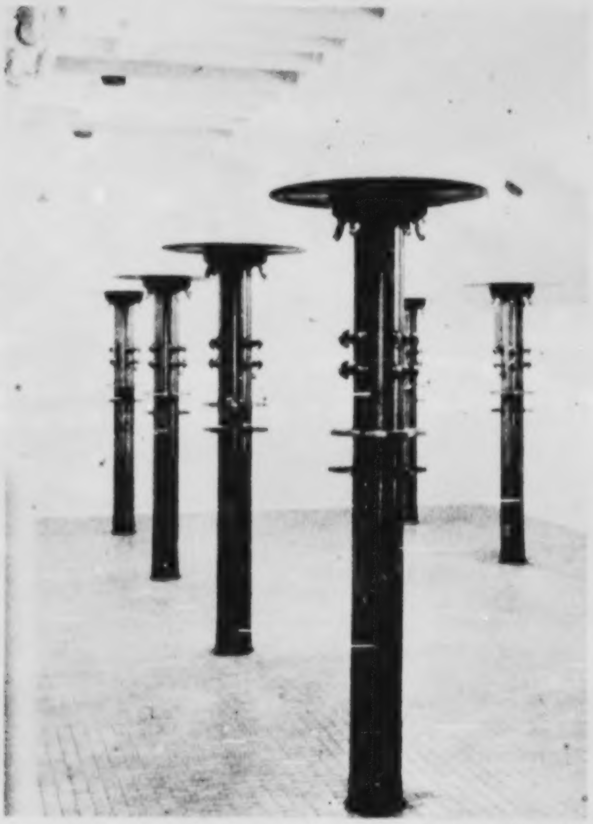
TOILET AND LAVATORY FACILITIES

Strategic placement of toilet and lavatory areas facilitates traffic pattern controls. This is extremely important for spectator events.

Locker room toilets and lavatories should be located near the shower and drying facilities. This area is not only the most convenient, but it allows for the piping to be localized and reduces installation cost. Several lavatories should be located near exits for convenience. There is need for better planning for dual use of these facilities. Figure 8 illustrates how space and lavatory equipment can be conserved when designated physical education and spectator lavatories are planned to serve both groups. Seldom are physical education classes in session concurrently with a large spectator sporting event.

Water closets and urinals should be hung from the wall to facilitate cleaning. Stalls should be securely anchored to the ceiling and walls. Because of frequent damage inflicted on metal partitions and their tendency to corrode, it may be economical to use glazed brick or tile partitions.

For the men's central locker room, there should be a minimum of two water closets, two urinals, and two hand lavatories for the first 30 students. Additional fixtures should be provided as follows: one urinal for every 20 students, one lavatory for every 20 students, and one water closet for every 30 students. For the women's central locker room, there should be a minimum of four water closets and two hand lavatories for the first 30 students. Additional fixtures should



Shower Room, Schoolcraft Community College, Livonia, Michigan; stainless steel stands with provision for liquid soap, soap dish and five shower heads per stand.

be provided as follows: one water closet for every 15 students and one lavatory for every 20 students. There should be at least one men's and one women's lavatory directly accessible from outside the building, so recreational groups and playground participants may use facilities without entering the building.

Paper towel dispensers are provided most frequently for hand drying and require waste disposal cans. Electric hand dryers are effective but more time-consuming. In toilet areas for women, dispensers and disposers for sanitary supplies are needed.

Lockers

The administrative and teaching personnel of the physical education staff should be active participants in the selection of the locker system, since they are familiar with the unique requirements of the program and the problems of locker room administration.

The locker system and locker dimensions must be established prior to the determination of the room size. Poor coordination between the architect and program planners frequently exists on this point, and as a result, it is often necessary to select lockers to fit within a given room size. The locker system and locker sizes, coupled with the plans for future expansion, should be the key criteria in determining a functional layout and overall size for the locker room. It is recommended that the number of lockers should be equal to the peak load plus 10 to 15 percent, with adequate allowance for overlapping classes, variations in class size, scheduling, and anticipated use by intramural, recreation, and athletic participants. Projected enrollment is another factor that must be considered.

Basic Locker Room System

The basic locker room system concerns the physical layout, placement of the dressing and storage lockers, and their relation to the various service facilities. In selecting the desired size of specific lockers and determining the most appropriate locker system, a number of questions need to be considered:

1. What equipment must be stored in storage lockers by physical education students?
2. What athletic equipment is provided and stored by the school?
3. Are other lockers available to students to store needed equipment?
4. Does the program require sweat suits and jackets for outside participation in cool seasons?
5. Will the same locker be used by a student for physical education and for an athletic team?
6. Who provides the gym suit?
7. Who provides the towel?
8. Is a laundry system available—or planned?
9. Will other groups—such as community recreation—be using the same locker facility?
10. What personnel are available to administer a basket system?
11. Is it feasible from a financial standpoint?

There are several locker systems to be considered. Selection should be made after carefully considering the following requirements of any system:

- Security of street clothing and physical education equipment
- Efficient utilization of space and facilities
- Control of odors
- Efficient administration for student
- Administrative feasibility, including supervision and maintenance
- Economy of operation
- Flexibility for utilization by different groups.

THE INDIVIDUAL DRESSING LOCKER

There is little doubt that the individual dressing locker best meets the needs of all participants. Costs in terms of space and initial investment make it possible to provide this convenience for all users. Usually, such lockers are installed for athletes, coaches, teachers, game officials, and professional major students.

The individual locker should be large enough to handle equipment for the sport requiring the maximum amount of space which, in most schools, would be football. If an equipment drying room is available, and if bulky equipment can be stored conveniently here, the size of the lockers can be reduced.

Mesh sides and doors offer the best visual inspection and maximum control of odors. The antiquated corridor locker is no longer acceptable. The locker should have an upper shelf for such items as books, preferably a low shelf for shoes, and adequate hangers.

DRESSING LOCKER AND BOX STORAGE SYSTEM

The dressing locker and box storage is the most common system for institutional use. Figures 9 and 10 show varia-

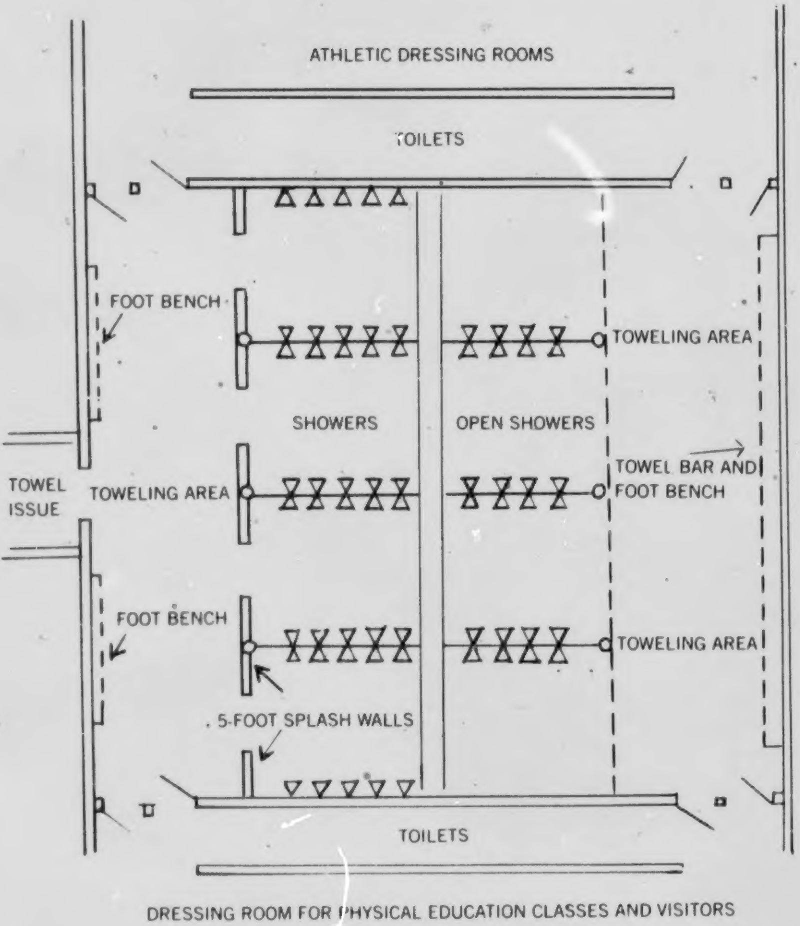


Figure 7. Sample Layout of Showers and Toweling Rooms.

tions of this arrangement. A series of smaller lockers to hold all personal equipment is usually located near a large dressing locker. Each box in a unit is assigned to a member of a different class, and therefore, during any given class each member has the use of one large dressing locker. In some cases, storage lockers are located in a separate area and transported to individual lockers. This system is more cumbersome, although it does allow for special ventilation to be used in the storage area. If the latter system is used, the uniform room and towel issue rooms should be located between the two areas for convenience.

Maximum security requires that the padlock of the box locker be transported to the dressing locker when in use and all contents of the box locker be placed in the dressing locker. Adequate supervision and operating instructions must accompany this system to ensure that students comply with this security factor.

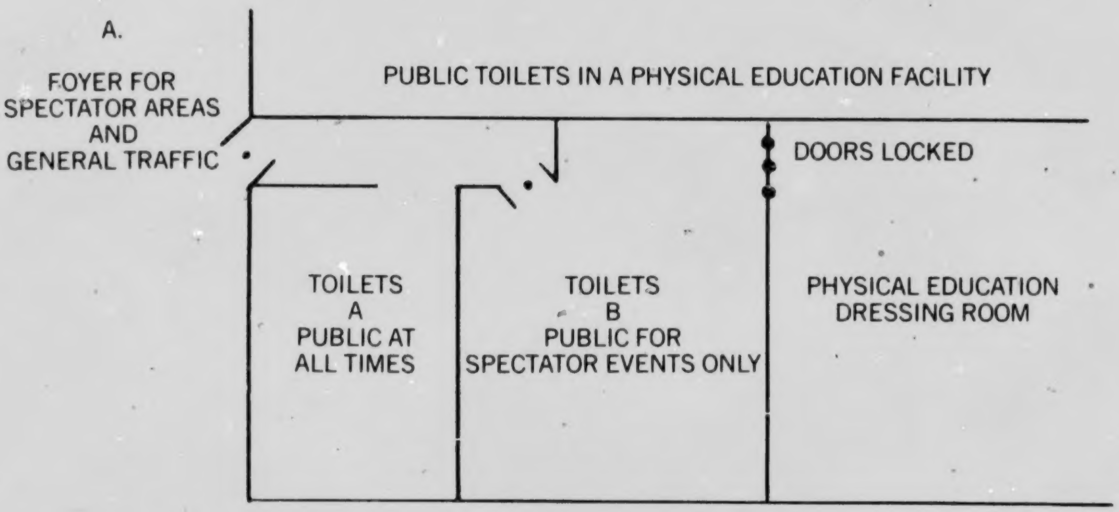
Administrators have experimented with attaching permanent combination locks on box lockers to eliminate need for lock control. In most cases, this system has not been satisfactory and is not recommended. Street clothes are not secure without an additional lock. The system also entails frequent changing of lock combinations when lockers are reassigned.

Color coding of lockers has proved to be a popular means of assigning lockers. It not only affords easy recognition, but assists in overall supervision and makes the locker room attractive.

The size of the box locker is of great importance to the success of a program. The tendency is to purchase lockers in sizes too small for efficient use. All locker companies build box lockers in sizes to coordinate with the dressing lockers. The best source of information is literature distributed by the manufacturer's representatives.

Increased shelf space rather than height has been found to provide more efficient storage in lockers. However, the program dictates the need. If tennis racquets are not furnished by a school presenting a tennis unit, that school has an obligation to provide adequate storage space somewhere in the building. Similarly, a school offering outside instruction in cool weather should reasonably expect to offer facilities that properly care for additional uniform needs.

For institutions that offer laundering of uniforms, the box locker plan, which can be serviced from the issue room by an attendant, has distinct advantages. This plan saves the student's time because uniforms can be changed when the area is not in use. The system also utilizes space more economically. Daily changes of uniform reduce odors in


A.
FOYER FOR SPECTATOR AREAS AND GENERAL TRAFFIC
PUBLIC TOILETS IN A PHYSICAL EDUCATION FACILITY
DOORS LOCKED
TOILETS A PUBLIC AT ALL TIMES
TOILETS B PUBLIC FOR SPECTATOR EVENTS ONLY
PHYSICAL EDUCATION DRESSING ROOM

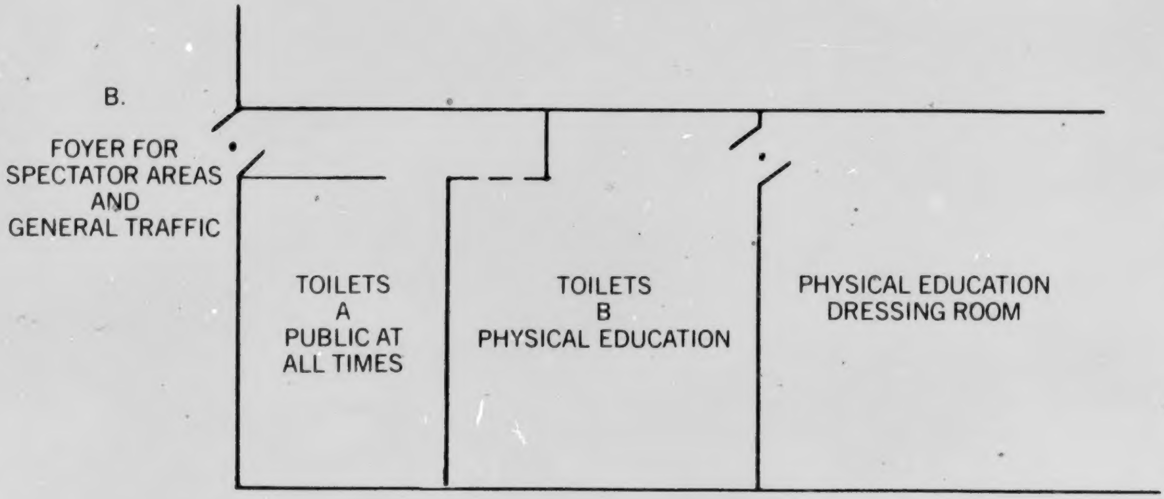

B.
FOYER FOR SPECTATOR AREAS AND GENERAL TRAFFIC
TOILETS A PUBLIC AT ALL TIMES
TOILETS B PHYSICAL EDUCATION
PHYSICAL EDUCATION DRESSING ROOM

Figure 8. Flexible Use of Toilets.

the building. The operational costs of this system, however, are naturally high because of increased labor costs for attendants.

TOTE BASKET SYSTEM

The tote basket system has been used most frequently in elementary schools or swimming pool areas (see Figure 11). It is administered in several fashions. In some operations, the basket is stored inside a storage room and issued through windows. The student carries the basket to the locker room area. Obviously, this system requires attendants and breaks down when a large number of students arrive and depart simultaneously.

In another type of arrangement, baskets are stored on special racks in the locker room itself. A student is issued a padlock and has ready access to his equipment. This plan frequently results in pilfering, since it is very difficult to construct baskets and supporting racks that withstand deliberate attempts to damage through force. When storage is to be done in the locker room in this fashion, storage lockers are preferred over baskets.

Another administrative plan for the tote basket system merits consideration. It allows for the storage of baskets on dollies for each class in a special security area. When the class arrives, the attendant rolls out the dolly and returns the baskets from the previous class to their proper place. In many situations, it would not be necessary to put locks on individual lockers as long as adequate supervisory controls are established.

The main advantages of the tote basket system are—

- A need for fewer standing lockers (wall hooks around the locker room perimeter may offer sufficient space for street clothes)
- Relatively good ventilation
- Economy of space.

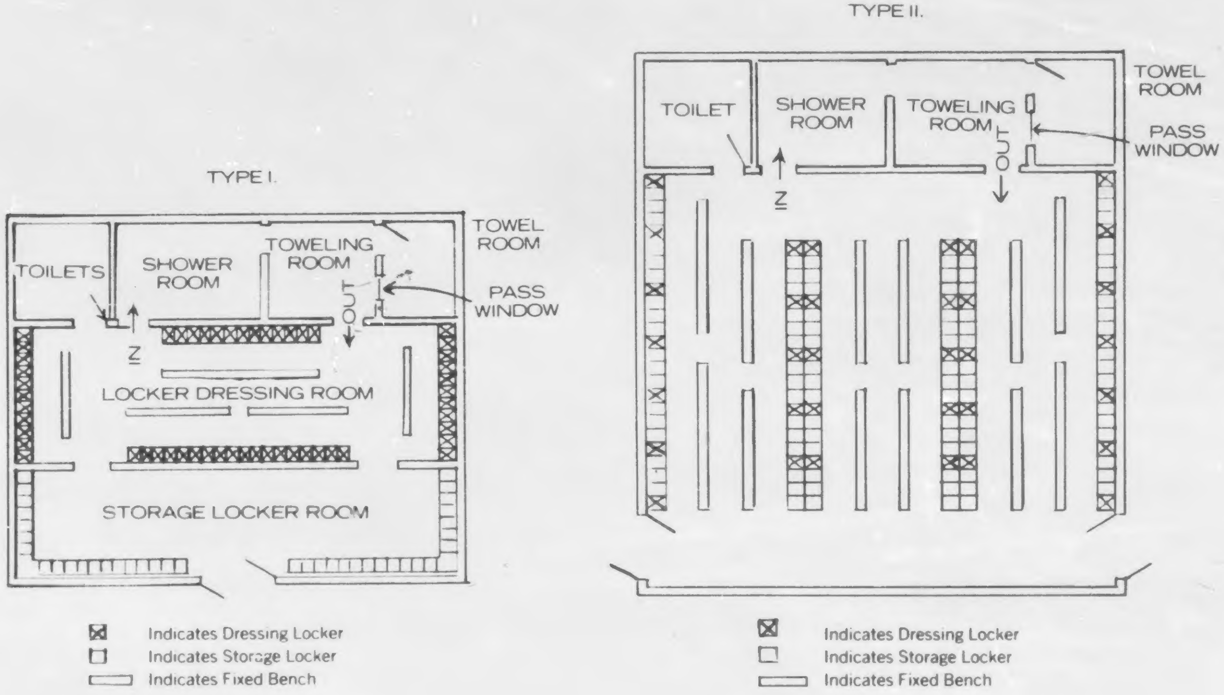
The disadvantages of this system are—

- Fragility of baskets
- Possibility of misplacing baskets
- Need for greater supervision.

There is a growing tendency to replace this system in elementary schools. If school systems are to give more than lip service to the community-school concept, the school must be built to handle the unique problems that exist when community groups utilize facilities. A locker system that is instituted for reasons of economy may be very costly in the long run if facilities cannot be used by the community when school is not in session.

Construction

The proper selection of lockers is imperative. Equipment of this nature should be chosen according to the nature of the program and the kind of usage it will receive. Failure to install quality materials can be extremely costly. The writing of specifications should be completed after a thorough study of locker construction. Most locker manufacturers will provide literature to assist in the writing of specifications. A number of considerations should be in-


TYPE I.
TOILETS
SHOWER ROOM
TOWELING ROOM
TOWEL ROOM
PASS WINDOW
IN
OUT
LOCKER DRESSING ROOM
STORAGE LOCKER ROOM
☒ Indicates Dressing Locker
☐ Indicates Storage Locker
▭ Indicates Fixed Bench
TYPE II.
TOILET
SHOWER ROOM
TOWELING ROOM
TOWEL ROOM
PASS WINDOW
IN
OUT
☒ Indicates Dressing Locker
☐ Indicates Storage Locker
▭ Indicates Fixed Bench

This Arrangement Separates the Clothing Storage and Dressing Areas

This Arrangement Combines the Clothing Storage and Dressing Areas

Figure 9. Illustrative Arrangements for Dressing Locker and Box Storage.

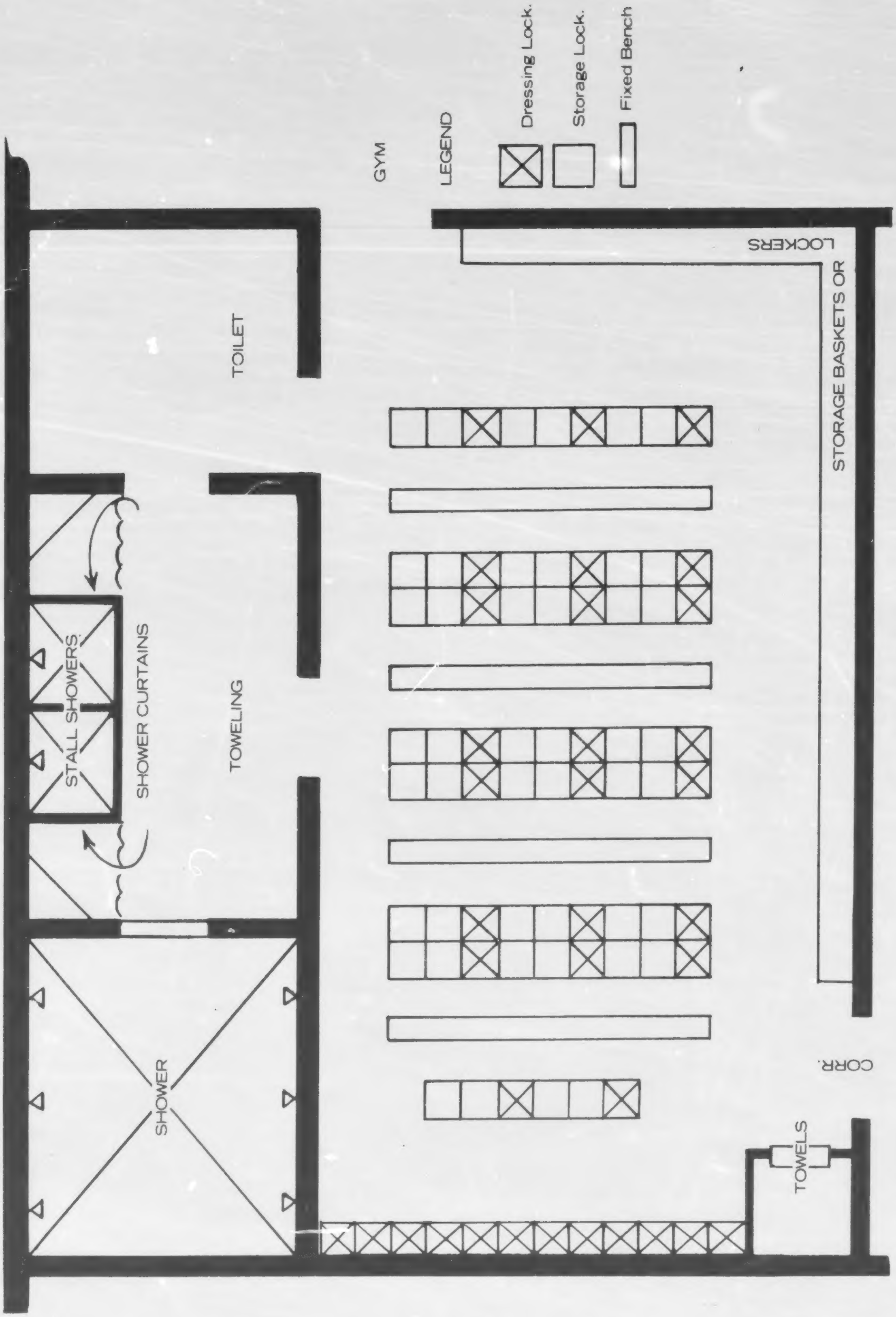

GYM
LEGEND
Dressing Lock.
Storage Lock.
Fixed Bench
TOILET
STORAGE BASKETS OR LOCKERS
STALL SHOWERS
SHOWER CURTAINS
TOWELING
SHOWER
CORR.
TOWELS

Figure 10. Combining Clothing Storage and Dressing Areas for Girls.

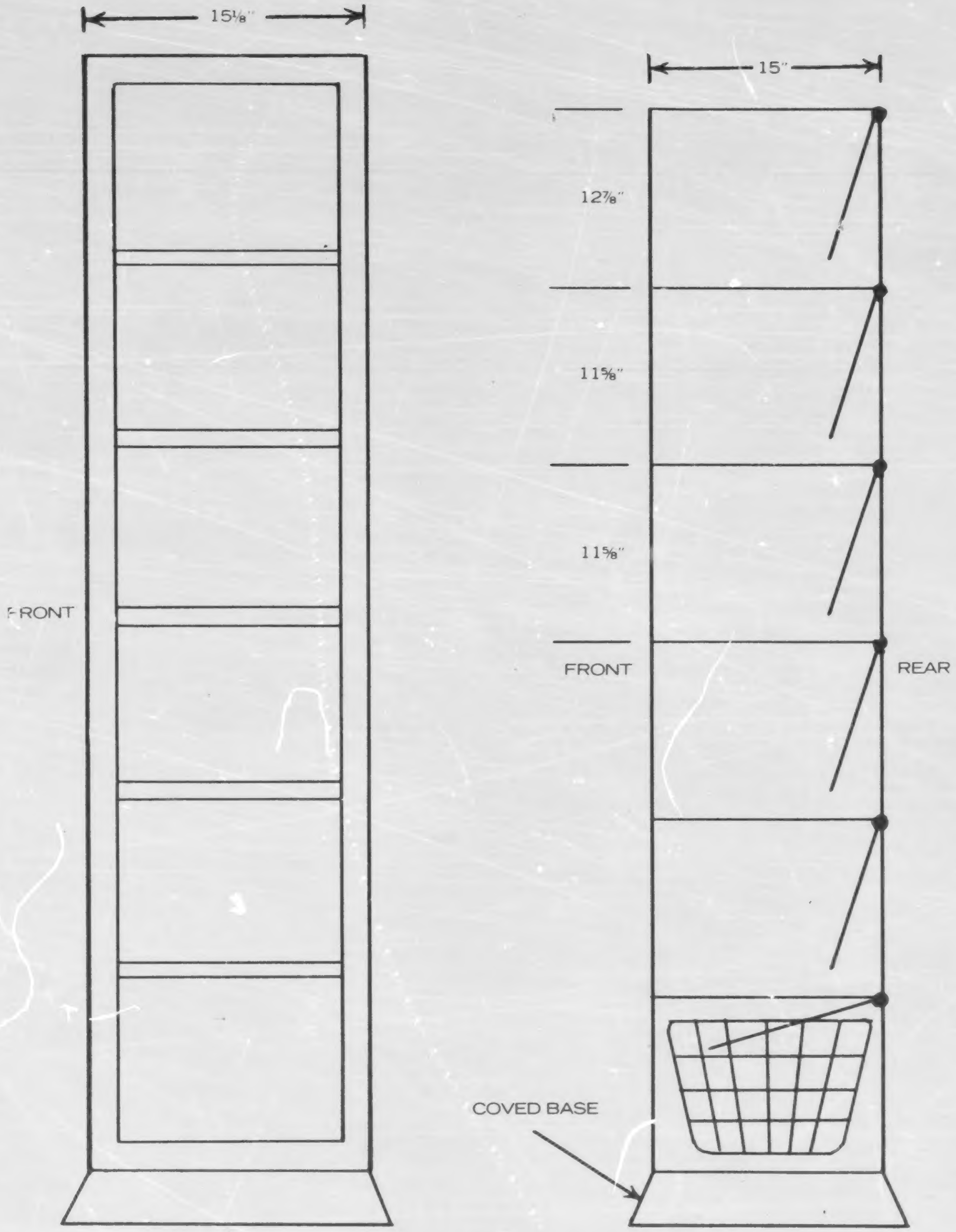

15⅛"
FRONT
15"
12⅞"
11⅝"
11⅝"
FRONT
REAR
COVED BASE

Figure 11. Front and Side View of Post-Office Box Lockers, Showing Doors, Baskets, and Markers in Rear.

Locker Area, Schoolcraft Community College, Livonia, Michigan.

cluded before a decision is made.

Sturdy, heavy-gauge metals should be used. Lockers normally receive extensive use and must serve for many years. Steel sheets are manufactured in thicknesses varying from .1196 to .0239 inches. Thickness in inches is measured in gauges. Normally, the doors are of greater thickness than the sides and back. Special materials are used as needed at locker ends or exposed areas.

Joining methods should be considered. It is advantageous, in most instances, to purchase the all-welded, factory-assembled unit, which is more sturdy and permanent than units delivered ready for assembling at the site with nuts and bolts. Although initial costs and charges are more for a preassembled unit, the savings are frequently absorbed by assembly costs and errors at the construction site.

A second consideration in locker selection is ventilation. Lockers with mesh construction assure adequate circulation of air, enhance drying, and reduce the growth of bacteria by the admission of light. There is general agreement that the locker room itself should be the drying room rather than a specially constructed room. A total room ventilation system is preferred to a system internally installed in lockers.

A third consideration for locker selection is the need for frequent visual inspection. This is an item of local concern, but it can be an important facet of administration.

Sloping tops have advantages in that dust cannot accumulate and they can be cleaned easily. Ventilation systems may be affected by the additional height necessary for sloping tops and this factor should be investigated before reaching a decision. When locker tops are low enough to allow frequent dusting, a flat surface does provide a convenient place for books while the locker is being opened.

The latching device for lockers should provide three-point latching—at the top, bottom, and door handle. Rod guides at the top and bottom should ensure proper security.

When lockers are placed back to back, a three to four inch forced air space should be left between the rear panels for adequate ventilation. The bottom of the locker should be attached to an eight-foot high coved base made of the same material as the floor. This permits cleaning of the floor by hosing and eliminates locker corrosion.

Benches should be secured to the floor with noncorrosive equipment. A fiberglass, plastic, or hard wood seat, eight inches in width with rounded edges and a smooth surface, should be 16 inches from the floor. Space between lockers and benches should be planned for traffic control and dressing comfort. The recommended allowances are 30 inches from locker to bench, eight inches for bench width, and a 30-inch passage between benches. Benches should extend the full length of each locker bank, with traffic break at intervals of 12 feet (see Figure 12).

In instances where locker banks do not extend for long stretches, significant space can be saved by using only one bench and eliminating the traffic passageway. When this method is elected, lockers that provide a recess at the door lock to keep the padlock from projecting to the aisle allow

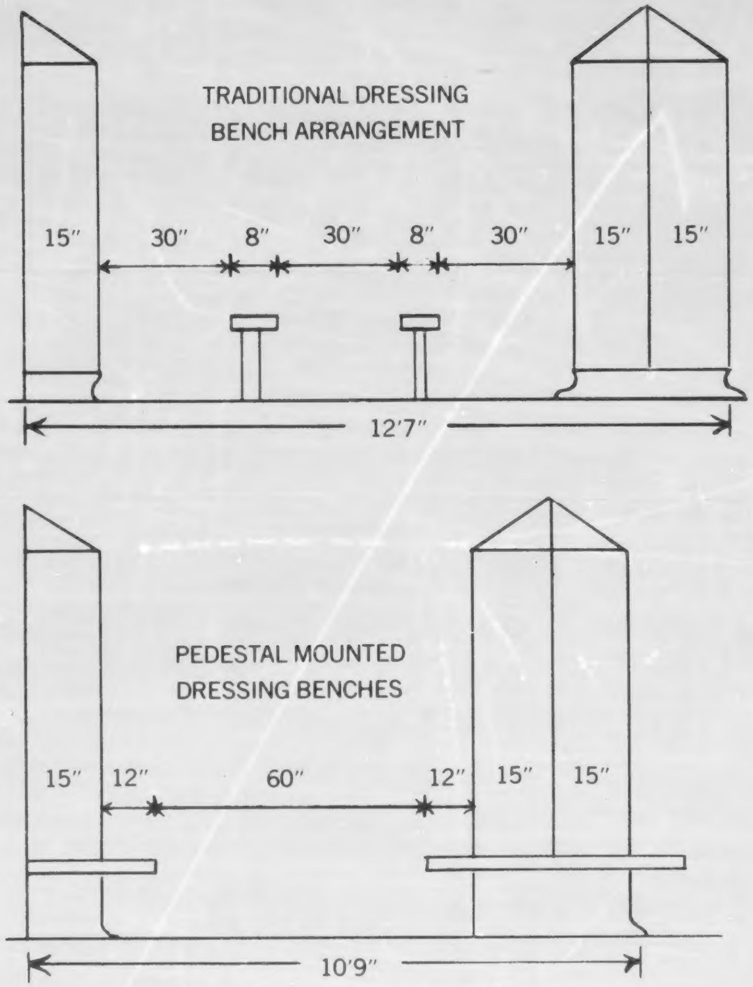

TRADITIONAL DRESSING BENCH ARRANGEMENT
15″
30″
8″
30″
8″
30″
15″
15″
12′7″
PEDESTAL MOUNTED DRESSING BENCHES
15″
12″
60″
12″
15″
15″
10′9″

Figure 12. Dressing Bench Arrangements.

for easier passage.

There are a number of features that make still a third arrangement very effective. The solid pedestal slab placed over the locker base, and extended out to form a bench on either side of the lockers, is being used frequently. This arrangement should be given serious examination. The prime advantages are that the aisles are unobstructed, cleaning is enhanced, safety is improved, and floor area is conserved.

Conservation of floor space should be analyzed. A double bench aisle arrangement, as illustrated in Figure 12, requires a width from locker to locker of 106 inches. The double bench pedestal arrangement takes only 84 inches if a spacious five-foot aisle is planned between two 15-inch projecting benches. In a 12-foot-long bank of lockers, the saving in square footage is more than 15 square feet. An alert physical educator might find valuable use for this space. The negative factors that should be weighed concern the height of lockers. Since the bench slab should be 16 inches high, the lockers will extend eight inches more than with the traditional eight-inch base. It is inconvenient for elementary school or short students to operate lock combinations on the top row of storage lockers. A 60-inch locker arrangement is recommended rather than 72 inches, if this style of bench is used. If 72-inch lockers are selected, the effects on lighting dispersion and room ventilation in a given situation should be analyzed, since the total locker bank height with a sloped top will exceed eight feet.

Physical Education Locker Sizes

Lockers and locker units are available in many sizes and combinations. They should be chosen after careful consideration of the needs. It is extravagant to provide more space than needed, but in most cases the lockers purchased are inadequate.

Typical combined storage-dressing room locker arrangements are usually selected according to the number of physical education periods available in a day. (Figure 13 illustrates a number of combinations.) In actuality, the selection becomes more complex than the illustration since much experimentation is in evidence in schools today. Frequent variations in lengths of periods and, therefore, changes in the number of periods per day will upset a carefully planned locker system. Modular scheduling, split sessions, and independent course study also tend to disrupt the operation of a well-planned system. The choice of the system should be made only after thorough discussion with administrative personnel concerning future operational plans.

Special Features of Elementary Locker Rooms

Physical education planners frequently find it difficult to convince responsible personnel of the need for adequate dressing and showering spaces for the elementary grades. Many schools provide very limited dressing facilities. However, those school systems that have been able to offer excellent instructional programs at the elementary level, including a change of clothing and shower, would be reluctant to eliminate this program.

All elementary schools should plan for the construction of locker facilities that allow pupils to change uniforms and shower. In the lower elementary grades, teachers should maintain control of security. Baskets on dollies that can be moved to secure areas are adequate. Another acceptable system is a series of shelves of box lockers, secured by padlocked doors. The teacher need only open several locker doors for each class, and the pupils have no need to operate locks.

For the upper elementary students, wire mesh lockers of sufficient size to hold personal equipment for intramural play should be available. If these lockers are purchased as a part of a system to include individual lockers, the large lockers serve a dual use for after-school activities. Failure to provide facilities of this nature will deprive physical education personnel from developing and planning a comprehensive program for the future.

The locker-shower complex should contain sufficient individual lockers to encourage faculty to assist with after-school student activities and to be active for their own recreation. Adult education and community groups should have lockers and space available for night classes. It is recommended that at least 600 square feet be designed to accommodate adult use. The multi-use concept requires that serious consideration be given to planning an area in elementary school locker rooms that can be utilized by athletic teams in the district. A dramatic increase in the number of athletic offerings, including a recent resurgence of girls' interscholastic athletic teams, has created real problems in facility scheduling at the secondary schools. Efficiency can be enhanced if adequate dressing and locker facilities for designated school teams are planned as a part of the elementary complex.

The height, size, and amount of such service facilities as showers, urinals, and drinking fountains should reflect the school-community philosophy and provide suitable units for all age groups.

The Athletic Team Locker Room

The development of diverse athletic teams and the tremendous growth in numbers of participants mandate special attention for team locker rooms. Frequently, planners fail to provide for the expansion of particular athletic programs and the introduction of new sports teams, in part because they may feel that taxpayers are unwilling to consider programs that do not exist at the time. As a school increases in population, a varsity football program, as an illustration, expands to include a separate junior varsity and freshman teams. Concurrently, the fall sports' program is broadened to include soccer, cross-country, and other teams. Growth may also take place in winter and spring programs and include the development of women's teams and intramurals.

A well-developed master plan will permit orderly expansion. The following recommendations should be considered:

1. Locker rooms should be planned so that at least one wall is an outside wall of the building. If the construction plan is designed to provide for future expansion, the addition can be put on at a future date.
2. The physical education locker arrangement can include team lockers interspersed throughout the room. A plan of this kind can allow one of the athletic teams—basketball, volleyball, golf, or wrestling—to use this dressing room without undue interference.
3. There is a trend toward providing separate, outside athletic locker rooms for sports such as football, soccer, baseball, track, and lacrosse. The space under bleachers or separate buildings allows for excellent facilities. Planners should consider the following points:

- Cleaning costs are reduced because players do not go back into the school building with dirty, sweaty uniforms.
- Cleaning can be accomplished by hosing down.
- Construction can include cinder block to reduce cost.
- The cost of providing utilities at the site is decreased.
- Administration of the teams is improved because of separation.
- Participants in after-school programs can continue to use school facilities without interference.
- Outside facilities such as public toilets, ticket booths, and refreshment stands can easily be made a part of the total complex.
- Participants in community recreational programs can utilize the facilities.
- The locker room is easily accessible from the playing site.
- Visiting teams can use one of the locker rooms.

The development of a total complex for the team should include coaches' offices and dressing, locker, and toilet facilities for players, visiting team, officials, and coaches. A training room, equipment issue room, meeting or lecture room, storage facilities, and adequate ventilation system for drying clothes are other needs for these team locker areas.

Lockers should be of open mesh, with expanded or perforated metal. All team lockers should be from 60 to 72 inches in height and at least 12 inches in width. If football equipment is stored in lockers, the lockers should be 18 by 18 inches. Serious consideration should be given to eliminating clothes lockers and providing proper hanging space and a small security locker for valuables in the football area. Ventilation, controlled automatically, involves the total area and assures proper drying. The administrative procedures must include proper identification of player equipment and security control to protect equipment from theft. Each of these arrangements can save valuable space by eliminating the need for a separate drying room.

Provisions should be made to separate the dressing areas of the various teams for security purposes. To ensure flexibility, partitions can be constructed of heavy, mesh screening.

The lecture room should be large enough to seat the members of a squad informally. It should include a bulletin board and chalk board and be equipped for such audiovisual equipment as films, overhead projector, and videotape review.

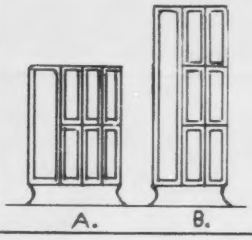
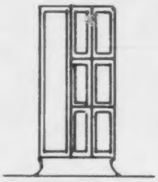
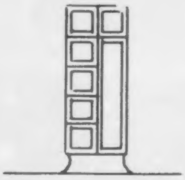
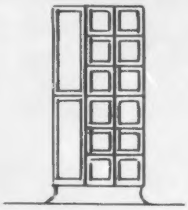
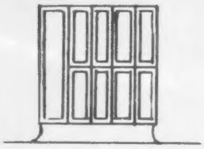
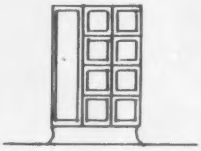
ADAPTATION	SIZE OF LOCKERS AND BATTERY ARRANGEMENT	ARRANGEMENT OF LOCKERS ONE PUPIL EACH PERIOD	OVER-ALL HEIGHT WITH 8" BASE	NUMBER STUDENTS PER DAY	AREA REQUIRED INCLUDES 4" FOR VENTILATION
6-PERIOD DAY	A. 6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48" B. 6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 72"		A. 56" B. 80"	240	A. 152 SQ. FT. B. 115 SQ. FT.
6-PERIOD DAY	6 STORAGE 9" x 12" x 20" 1 DRESSING 12" x 12" x 60"		68"	240	115 SQ. FT.
6-PERIOD DAY	6 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	240	93 SQ. FT.
6-PERIOD DAY	12 STORAGE 12" x 12" x 12" 2 DRESSING 12" x 12" x 36"		80"	240	133 SQ. FT.
7-8 PERIOD DAY	8 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48"		56"	320	187 SQ. FT.
7-8 PERIOD DAY	8 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	320	133 SQ. FT.

Figure 13. Typical Combined Storage-Dressing Locker Arrangements.

University of Utah Athletic Equipment Room.

STORAGE ROOMS

Proper storage areas that serve the various teaching stations enhance the quality of programs. Over a period of years, a suitable storage system has significant economic advantages because of increased security and the proper care and maintenance of supplies and equipment. Staff planners need to convince architectural designers that it is imperative to have adequate space.

The planners of any kind of storage area must be familiar with the fire laws regarding the particular type of construction and the area in which the facility is built. For example, certain fire laws state that storage is not permitted under stairways unless the total construction is concrete and includes the installation of metal fire doors.

There are several kinds of storage areas that need to be developed. In many cases it is possible to combine these areas efficiently; however, for purposes of identification, they are considered individually in the following sections.

Supply-Issue Room

Adjoining the locker-dressing room, there should be a storage room for issuing physical education clothing and instructional equipment. It can also serve for towel issue and retrieval. Usually, a Dutch door or retractable metal partition is used. Those using outside facilities should have access through a small opening to the outside.

Sufficient shelving and an efficient hanging system for special equipment must be included. A sturdy locking device to safeguard equipment is necessary.

Out-of-Season Storage and Repair

An equipment storage space for extra supplies and out-of-season equipment is best located immediately adjacent to the issue room, but separated by a solid wall with door. A small area should be provided for equipment repair. This room should be organized for easy inventory and effective administration. Tilted shelves or noncorrosive bars are convenient for ball storage and other items. Installing these devices about an inch from the wall facilitates cleaning. Level shelves are needed to store most items. Bins are convenient for gymnasium equipment, hockey sticks, and baseball bats. Proper ventilation and humidity regulation are absolutely necessary for this room or supplies will deteriorate over a period of time.

Gymnasium Storage Room

This room should be located on the gymnasium level and be immediately adjacent to the teaching station. When partitions are used to divide the gymnasium into several stations, each station should have either a separate storage room or a separate opening to one large storage area.

Double doors with flush sills and of sufficient height to accommodate a folded trampoline will facilitate movement of apparatus and equipment such as ping-pong tables and tumbling mats. Invariably, these rooms are made smaller than necessary. Although a minimum area needed for storage of large equipment is recommended at 250 to 300 feet, extra precautions should be taken by the physical education personnel to ensure sufficient space. The following procedure is recommended:

1. Make a list of all equipment and projected purchases that need to be stored.
2. Draw to scale on graph paper the storage space needs for each and cut out templates.
3. Arrange templates on scaled architect paper to indicate space needs.
4. Present the data to administrative personnel as verification of space needs.

In facilities that contain a separate gymnastics and tumbling room, apparatus can remain in that room when not used and eliminate storage needs. Selected activities that do not require a full teaching station can use that room when gymnastics classes are not conducted.

Some school systems transport gymnastics equipment from school to school to save duplication of purchases. Thus, a school retains the apparatus only while it is being used, and only one school of the group requires space for gymnastics equipment storage.

Community Recreation Storage

The community recreational program requires storage space. The sharing of equipment and the misuse of equipment are frequent sources of agitation between school and community groups. It is recommended that definite storage spaces be designated for the community program and adequate security measures be taken for both school and community equipment.

Audiovisual Equipment Storage

Effective use of audiovisual equipment mandates that accessible, well-protected, and secure areas be located at the instruction site. Videotape recording and instant replay equipment are invaluable as teaching aids. In order to reduce damage due to handling, a small secure area should be available in which to store the equipment on a movable cart. The equipment can then be operational with a minimum of preparation time.

There is also need for one audiovisual equipment storage room accessible from the administrative areas, which can be used as a master storage area for audiovisual equipment and auxiliary supplies (see Part Two, Chapter 4).

Field Storage

If the main building is used for storage of outdoor equipment, the storage room should be located near the field exits. Such equipment would include archery targets, line-marking apparatus, bases, football charging sleds, tools, and the like.

It is preferable to store these materials away from the main building and near the play areas, to prevent dirt from being tracked into the school and to allow easy access to the equipment. A building designed as a separate athletic team locker room affords an excellent space. Small outside sheds are frequently used, but they are subject to vandalism unless they are well-constructed and have a good locking device.

Athletic Team Storage Room

For purposes of control and accountability, storage rooms for athletic teams should be separate from those for physical education. Preferably, they should be adjacent to the team locker room for orderly issue of equipment. Shelving that allows easy categorizing of sizes should be provided. Open-end cubicles facilitate the storage of helmets, pads, shoes, and other bulky items and provide for free circulation of air.

Cedar-lined closets serve to safeguard woolen goods. Tables are needed on which clothes can be folded prior to distribution. A work area for the repair of equipment should be a part of or near the room.

Controlled ventilation, temperature, and humidity are necessary to prevent deterioration of clothing, leather, and rubber goods.

The storage space must have maximum security. It is advisable to make provision for segmenting the shelves for respective teams with heavy wire-mesh screening.

Issue, inventory, and retrieval of uniforms is a function of the storage complex. The most convenient location for the issue room is immediately accessible to the locker room and separated from the storage room. Laundry may also be distributed from the issue room.

LAUNDRY

If a healthful school environment is one of the requisites of the educational program, laundry facilities for physical education and athletic programs should be promoted. Reduction of illnesses and skin infections, minimizing odors, improved appearance of uniforms, and a general attitude toward cleanliness are all benefits of a laundry. A well-administered system can lower laundry costs, reduce inventory, reduce losses due to theft, and provide general economic advantages to students and administration.

The decision to institute a laundry involves a complete feasibility study to determine if it is more economical than contracting with commercial companies. Renovation of old buildings is costly because of the need for extensive installation of heavy-duty utilities and the special features needed for room construction. A cost analysis should include such factors as personnel, equipment, building maintenance and use, utilities, supplies, and deliveries.

Location

The laundry room should be directly located off a corridor and preferably near the locker room area. Installation costs can be minimized if the laundry is situated near the shower and toilet facilities. The room should have direct access to a service roadway for transporting laundry to and from areas located away from the main site. Ramps should be installed if laundry dollies are to be transported from different floor levels. Provision must be made for adequate security of the area.

Size

The total size of a laundry room is dependent primarily upon the quantity of laundry to be handled and the number and kind of machines to be installed. There must also be adequate space to perform routine related tasks. Storage shelves for clothes and supplies, space for laundry dollies, tables for folding and ironing, and a work space for issuing clothing and for general organizational purposes must be planned as additional features of the room. Adequate room for maintenance and repair should be left near the machines.

Equipment

Selection of equipment should precede architectural planning. Decisions relating to equipment purchase merit careful deliberation. Literature from the various manufacturers describes special features and should be compared closely.

The size of the machines depends upon the size of peak loads. It is worth investigating the purchase of several machines of different sizes, instead of one large machine to wash all items. Delicate fabrics can usually be handled in the smaller machines, and at least one of the machines is available to hande all of the work in the event that repairs must be made on others.

Investigation should be made concerning purchase of the combination washer extractor or separate machines. The combination has advantages for institutional use since it allows for a greater load to be handled in a given period of time. It also requires less space, less employee time, and less capital outlay.

The selection of dryers requires close investigation of the various machines manufactured. A series of dryers is preferable over one large dryer for most institutions. Preference for gas, electric, or steam must be decided on a local basis according to costs in terms of money and personnel. The same is true of the special features offered by various companies.

There should be at least a minimum ironing service available. Modern fabrics have eliminated the need to iron athletic uniforms, but on special occasions some ironing service will be necessary.

A sink should be installed for items requiring special care for stain removal or special rinsing. Figure 14 illustrates two layouts for a laundry room.

Physical Features

WALLS

Room construction should ensure that the laundry room can be operated functionally and efficiently with minimal maintenance cost. The side walls should be soundproof, to prevent the noise of the machines from disturbing nearby school activities. In addition, some of the walls should be clear of obstacles or windows to allow for well-organized shelving spaces. Space should be provided for storage of laundry room supplies as well as for systematic storage of clothing or uniforms by sizes.

Doorways must be of sufficient size to permit replacement of machinery. Swinging doors with protective guards attached at the bottom are recommended. Flush sills allow laundry trucks to move in and out freely.

CEILINGS AND LIGHTS

Ceilings should be moisture-resistant because of the high humidity. Acoustic treatment will reduce noise transmission to upper levels. Beams should be of sufficient supportive strength to assist movement of machinery with pulleys.

Lights should be vaporized and furnish 50 footcandles of illumination throughout the room (see Part Two, Chapter 7).

FLOORS

Floors should be sloped to drains. They should have a moistureproof, nonskid surface that is resistant to detergents and bleaching materials. Sufficient space should be maintained between work areas to allow for efficient work patterns.

The floor should be durable enough to withstand considerable vibration and weight. Most machine manufacturers specify the construction of elevated, concrete bases for the installation of machines. In some instances shock-absorbing features are built into the machines and eliminate the need for bases.

UTILITIES

The heavy demands of laundry equipment require close conformity to manufacturers' recommendations on utilities. Laundry equipment should be selected prior to pipe installations to ensure use of proper sizes.

Institutional machines use large amounts of hot and cold water. Steam must also be available. Machines must allow regulation of water temperature for various fabrics.

Provisions must be made for both 220 and 110 volt outlets. Manufacturers' specifications should be followed to prevent overloading. Sufficient outlets for auxiliary use should be spaced throughout the room.

Control of heat and humidity is always a problem unless adequate provision has been made to control climate. A location in the building that allows for good exhaust ventilation is an economical asset.

THE TRAINING ROOM

Planning for an athletic training room first involves a thorough understanding of institutional needs. In large universities, a large training room often services athletic teams exclusively while a student health center generally services the student body. In a smaller college, the training room can be planned as a multipurpose facility to incorporate the functions of all the campus needs. In contrast, secondary schools usually designate a small area for athletic teams and locate health services elsewhere in the building. There is a definite need for, and a growing trend toward, providing athletic training rooms in secondary schools.

The full purpose of the facility must be clearly understood. The physical therapy staff should be consulted along with the physical education department to coordinate overall institutional plans.

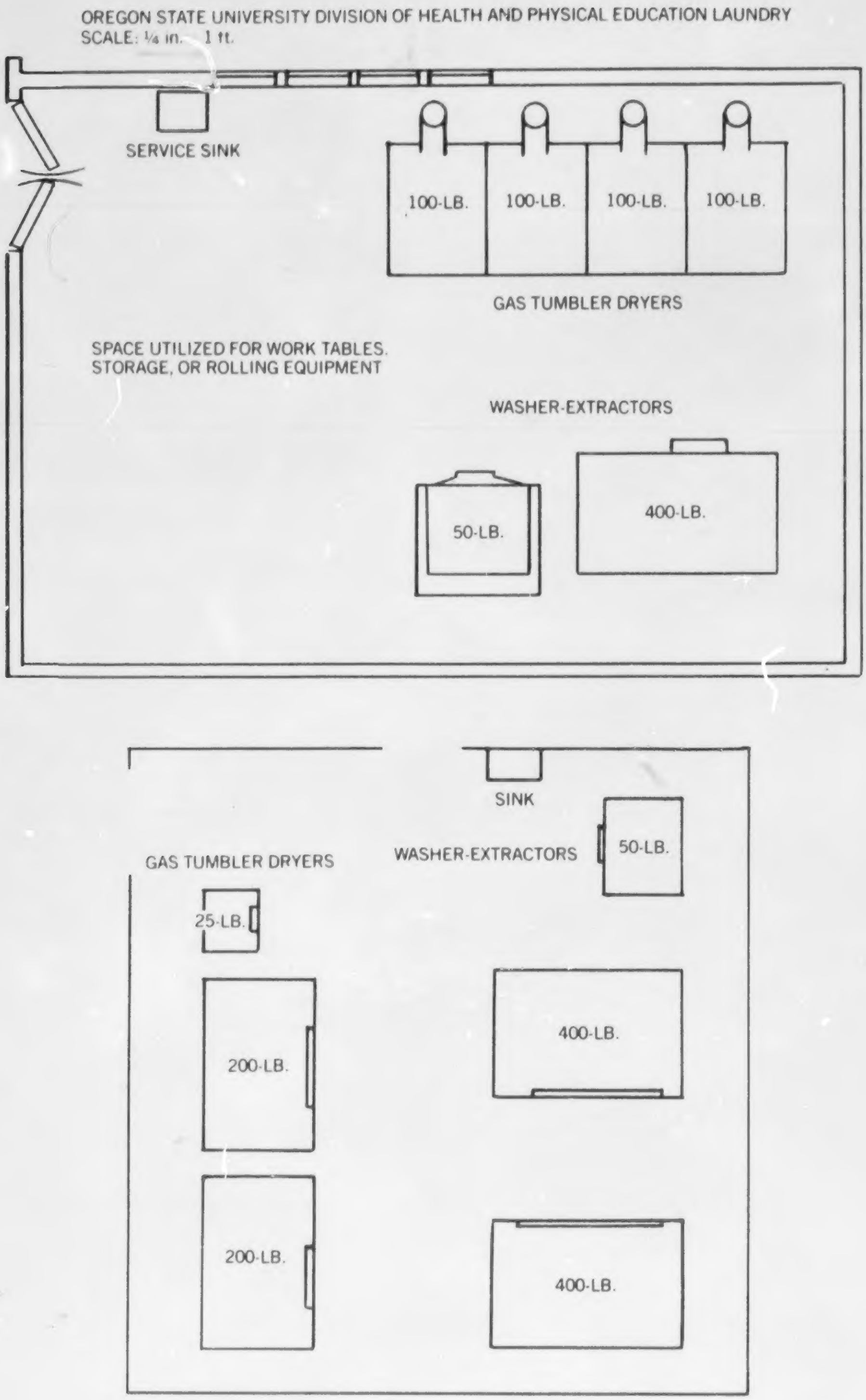

OREGON STATE UNIVERSITY DIVISION OF HEALTH AND PHYSICAL EDUCATION LAUNDRY
SCALE: ¼ in. 1 ft.
SERVICE SINK
100-LB.
100-LB.
100-LB.
100-LB.
GAS TUMBLER DRYERS
SPACE UTILIZED FOR WORK TABLES, STORAGE, OR ROLLING EQUIPMENT
WASHER-EXTRACTORS
50-LB.
400-LB.
SINK
GAS TUMBLER DRYERS
WASHER-EXTRACTORS
50-LB.
25-LB.
200-LB.
400-LB.
200-LB.
400-LB.

Figure 14. Laundry Room Layout.

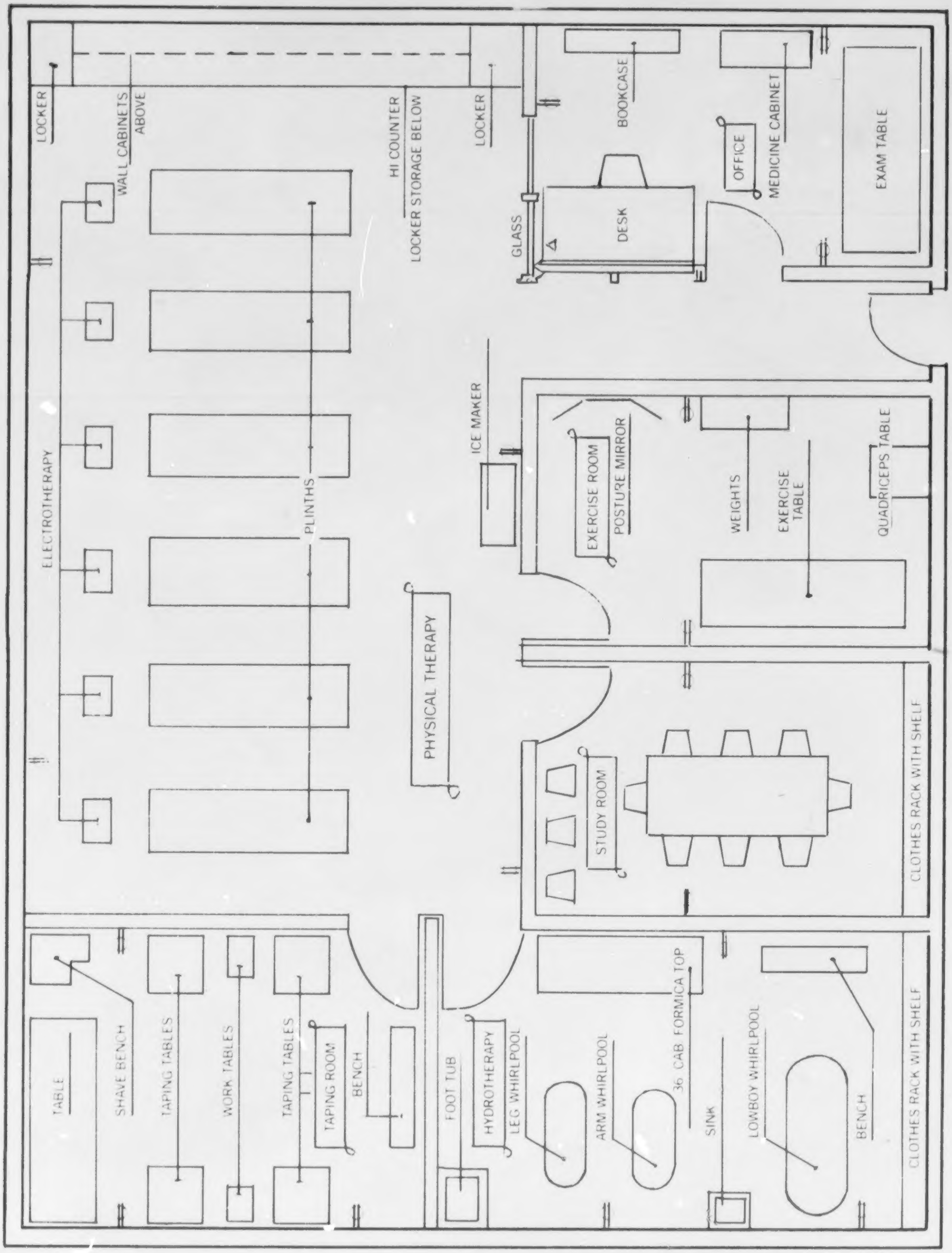

LOCKER
WALL CABINETS ABOVE
HI COUNTER LOCKER STORAGE BELOW
LOCKER
BOOKCASE
MEDICINE CABINET
OFFICE
EXAM TABLE
DESK
GLASS
ELECTROTHERAPY
PLINTHS
ICE MAKER
PHYSICAL THERAPY
EXERCISE ROOM
POSTURE MIRROR
WEIGHTS
EXERCISE TABLE
QUADRICEPS TABLE
STUDY ROOM
CLOTHES RACK WITH SHELF
TABLE
SHAVE BENCH
TAPING TABLES
WORK TABLES
TAPING TABLES
TAPING ROOM
BENCH
FOOT TUB
HYDROTHERAPY
LEG WHIRLPOOL
ARM WHIRLPOOL
36" CAB FORMICA TOP
SINK
LOWBOY WHIRLPOOL
BENCH
CLOTHES RACK WITH SHELF
0
5

Figure 15. Central Training Area.

1 LOCKABLE DOOR
2 POWDER, BENZOIN BENCH
3 THERAPY TABLE
4 PHYSICAL MODALITY
5 TAPING TABLE
6 KNEE-TAPING BENCH
7 RUBBER RUNNER
8 COUNTER
9 SINK
10 STOOL
11 ANKLE WRAPS
12 HYDROCULATOR
12 WATER OUTLET (FOR FREEZER)
14 FREEZER
15 TABLE ICE CRUSHER
16 MEDICINE CABINET
17 SHELVES
18 DEHUMIDIFIER
19 DESK
20 FILE
21 BOOKCASE
22 LOCKER
23 WEIGHT SCALE
24 BULLETIN BOARD
25 MIRROR

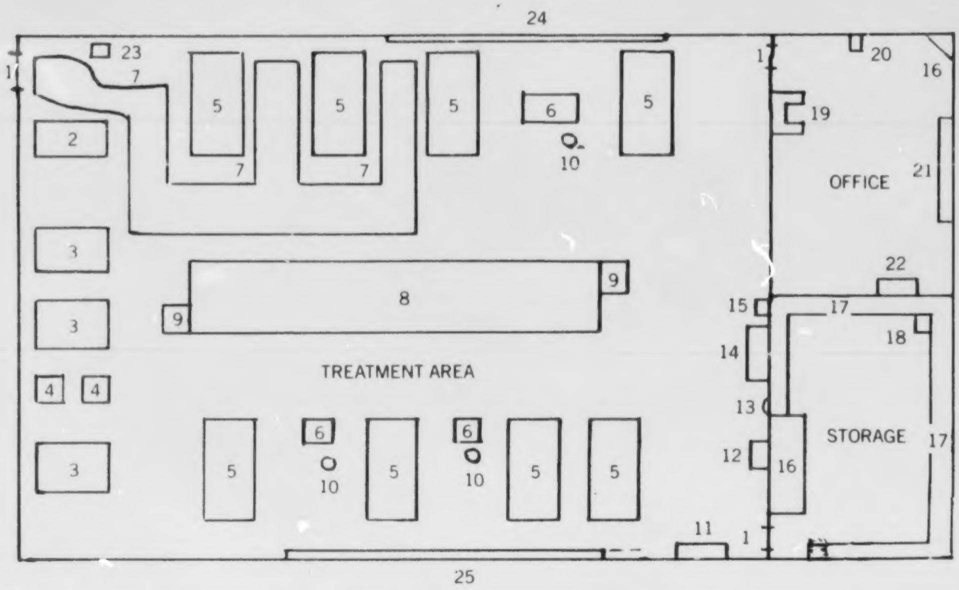


Figure 16. Training Room.

Because medical equipment is expensive, it is wise to share equipment among various programs to avoid duplicate purchases. On the other hand, it is expensive in terms of student time and staff personnel if the location of the training room is not close to the student body.

If a first-aid or a prevention-of-injury class convenes on campus, it is most appropriate to locate a lecture room near the training room to allow practical experience for the students.

The following specifications will accommodate the needs of a well-organized athletic team training room. Institutional size and predicted use of the training room should determine the overall design and construction features.

Location

A training room should be centrally located close to locker facilities. It should not be planned as an integral part of a locker room, but rather be accessible to all students. Ambulance service should have access to the building entrance or to a ramp leading directly to the training room.

The location should permit use by all sports. If some athletic programs are located in inconvenient areas, there is need to establish small stations for auxiliary use. Visiting teams need an area close to their locker room as a station for routine training duties.

Physical Features

The construction of the training facility should be appropriate for a building that is subjected to moisture and heat. The lower half of the walls should have tile or a similar smooth, washable surface for cleaning purposes. A moisture-resistant, painted surface is sufficient above the tile.

Electrical outlets of sufficient voltage to handle the various special equipment should be located approximately four feet from the floor. Outlets for 220 volts should be labeled properly.

The ceilings, at least 10 feet in height, should be of acoustic tile or equivalent and decorated with light colors. See Part Two, Chapter 7, for lighting specifications. Except for aesthetic value, windows are not necessary for lighting purposes. If separate rooms are provided in the training area, windows should be installed in the walls in order to maintain surveillance of all spaces.

The floor should be of a smooth, water-resistant surface for easy cleaning. It should resist both discoloration from spilled solutions and from dropped training weights or heavy equipment.

Layout

The layout of the training room should facilitate control of traffic and reduce crowding. Placement of the most frequently used areas close to the room entrance makes it possible to divert the majority of patients readily and to eliminate the need to pass through the main sectors of the training room. Dispensing of adhesive bandages and other minor items can be accomplished from a Dutch door located away from the main training room entrance and opening into the corridor. Reducing the traffic will make for a more efficient operation (see Figures 15, 16, and 17).

A water closet and lavatory should be available for all patients.

Reception and Office Room

There is need for an administrative area. Depending upon the particular plans for use, a receiving counter can serve as a point of entrance and traffic control. The main office should be located adjacent to the counter area but separated by walls. It is advisable to have a glass exposure from the office to the treatment area for supervision purposes. This room should be large enough to include the following as needed:

- Desk
- Filing cabinets for records
- Special medicine storage
- Bookcases
- Chart areas/bulletin board
- Lockers.

Extensive training rooms require separate offices for doctors and dentists.

Storage Area

A storage area should be designed to keep supplies properly conditioned. This area should be planned to contain the following:

- Adjustable shelving for sanitary storage
- Counter space for dispensing
- A sink with hot and cold water
- Cabinet storage for small items
- Adequate ventilation and humidity control.

Treatment Area

The treatment areas are generally planned as separate stations for the following:

- Hydrotherapy
- Electrotherapy
- First aid and taping
- Ice therapy.

Hydrotherapy treatment should be handled in a partitioned area to facilitate humidity control. If partitions are used, there should be windows in the walls or the lower portion should be of glass to allow for supervision. The walls and floor should be tiled to resist moisture. Adequate drainage is

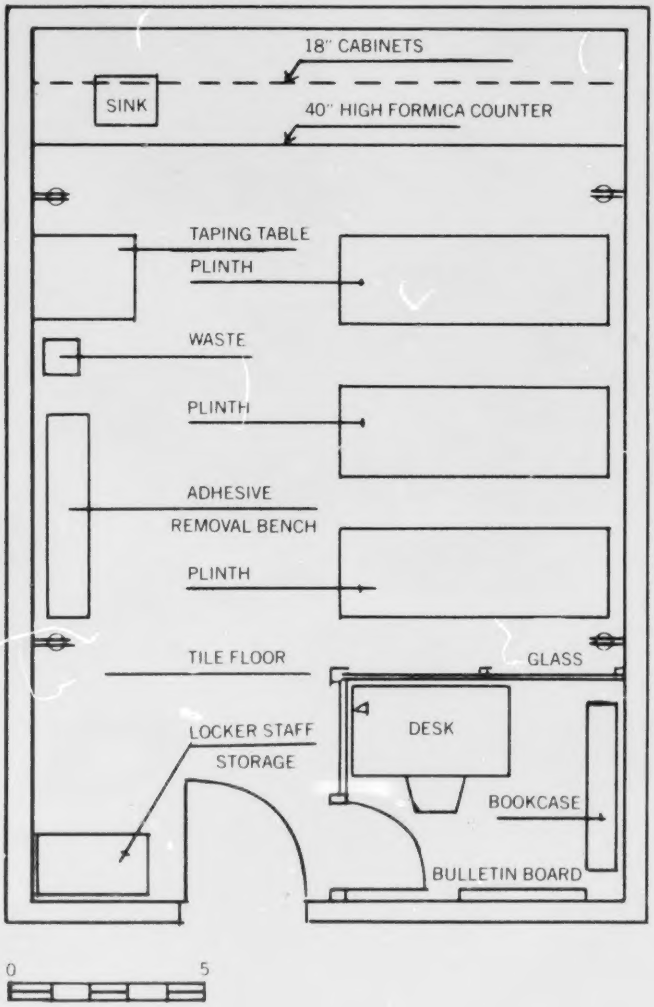

18" CABINETS
SINK
40" HIGH FORMICA COUNTER
TAPING TABLE
PLINTH
WASTE
PLINTH
ADHESIVE
REMOVAL BENCH
PLINTH
TILE FLOOR
GLASS
DESK
LOCKER STAFF
STORAGE
BOOKCASE
BULLETIN BOARD
0
5

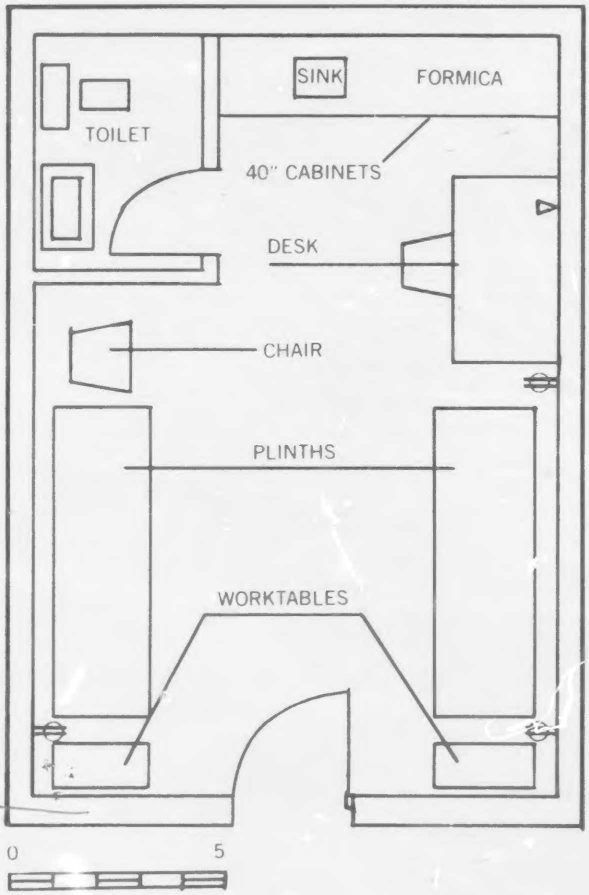
Figure 17. Auxiliary Training Room.

necessary. Electrical outlets and plumbing should be planned to accommodate whirlpool baths (individual ones are preferred), foot tubs, shower stalls, and a sauna. An ample supply of both hot and cold water is needed at all times. A wide variation in water temperature is necessary for the proper operation and maintenance of hydrotherapy equipment. High stools for use of equipment are needed.

The electrotherapy space should be separated with curtains or dividers. Enough wooden treatment plinths are necessary to provide work space for each piece of equipment. Electrical outlets, of sufficient voltage for ultrasonic equipment, should be located four feet from the ground at the head of each table.

The taping and first-aid areas (see Figures 18 and 19) are subject to the greatest use and, therefore, should be located relatively close to the entrance and exit areas. Treatment is most frequently for emergency first aid and the preparation of athletes. From this location individuals requiring additional care are directed to other treatment areas. A special station outside the training room for dispensing routine first-aid materials will markedly reduce congestion in this area. For a large central facility, the taping room should contain at least four plinths. The height of the room in this area should allow a patient to stand on the work table. Supply cabinets and ankle wrap rollers should be accessible to each plinth.

Ice therapy has become increasingly popular. An ice-making machine and a freezer should be located in the training room to maintain the ice supply. The freezer should be located next to the room entrance so that athletes may readily obtain ice as they enter. Next to the freezer a water outlet, equipped to handle a hose with a nozzle control, should be provided. With the hose, containers can be filled while they are in the freezer. In this same area, a hydroculator may be located. The hydroculator is used for steam packs for contrast therapy and treatment of infections.


SINK
FORMICA
TOILET
40" CABINETS
DESK
CHAIR
PLINTHS
WORKTABLES
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5

Figure. 18 First-Aid Room.

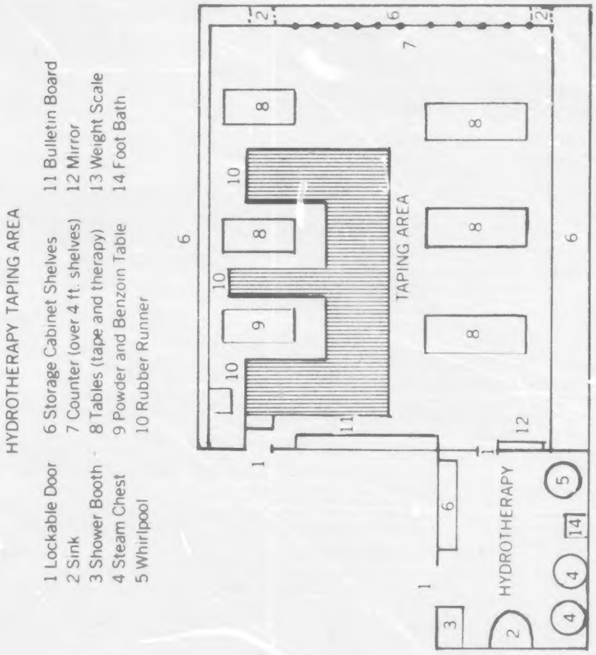
HYDROTHERAPY TAPING AREA
1 Lockable Door
2 Sink
3 Shower Booth
4 Steam Chest
5 Whirlpool
6 Storage Cabinet Shelves
7 Counter (over 4 ft. shelves)
8 Tables (tape and therapy)
9 Powder and Benzoin Table
10 Rubber Runner
11 Bulletin Board
12 Mirror
13 Weight Scale
14 Foot Bath
TAPING AREA
HYDROTHERAPY
1
2
3
4
5
6
7
8
9
10
11
12
14

Figure 19. Hydrotherapy and Taping Areas.

Chapter 6

SPECIFIC CONSTRUCTION FEATURES for the HANDICAPPED

This material is reproduced from *American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped*, A117.1, Copyright 1961 by ASA, copies of which may be purchased from the American Standards Association at 10 East 40th Street, New York, New York 10016.

This standard supplements other American Standards relating to various aspects of buildings and facilities. Its specifications, which are the result of extended and careful consideration of available knowledge and experience on this subject, are intended to present minimum requirements. They are recommended for use in the construction of all buildings and facilities and for adoption and enforcement by administrative authorities, so that those individuals with permanent physical disabilities might pursue their interests and aspirations, develop their talents, and exercise their skills.

The ASA Sectional Committee, A117, which developed this standard, had the following representation:

LEON CHATELAIN, JR., Chairman
T. J. NUGENT, Secretary

Organization Represented

AFL-CIO
American Foundation for the Blind
American Hospital Association
American Hotel Association
American Institute of Architects
American Municipal Association
American Occupational Therapy Association
American Physical Therapy Association
American Society of Landscape Architects
American Society of Mechanical Engineers
American Society of Safety Engineers
American Vocational Association
Associated General Contractors of America
Association of Casualty and Surety Companies
Construction Specifications Institute
Federal Housing Administration
General Services Administration
Industrial Home for the Blind
Industrial Medical Association
Indoor Sports Clubs, Inc.
Institute for the Crippled and Disabled
National Bureau of Standards
National Congress of Organizations for the Physically Handicapped
National Council of Churches
National Council on Schoolhouse Construction
National Elevator Manufacturing Industry
National Paraplegia Foundation
National Rehabilitation Association
National Safety Council
National Society for Crippled Children and Adults (sponsor)
Paralyzed Veterans of America, Inc.
Paraplegics Manufacturing Company
Plumbing Fixture Manufacturers Association
President's Committeee on Employment
  of the Handicapped (sponsor)
Society of Industrial Realtors
Telephone Group
United Cerebral Palsy Association, Inc.
U. S. Conference of Mayors
U. S. Department of Health, Education and Welfare
  Bureau of State Services
  Children's Bureau
  Division of Accident Prevention
  Division of Hospital and Medical Facilities
  Office of Education
  Office of Vocational Rehabilitation
U. S. Department of Labor
  Bureau of Employment Security
  Bureau of Labor Standards
U. S. Veterans Administration
University of Illinois Rehabilitation Center

The steering committee

K. Vernon Banta
Leon Chatelain, Jr.
Clinton H. Cowgill
Philip A. Klieger
T. J. Nugent
Jayne Shover
H. Dwight York

SUMMARY

A little coordinated planning can open up many new worlds to millions of people. We are wasting shameful amounts of money and human resources because we have overlooked some relatively simple things. We must make all buildings and facilities accessible to, and usable by, the disabled and the aging.

The disabled and the aging can be accommodated in all buildings and facilities used by the public:

- independently and without distinction
- without loss of space or function to the general public
- without significant extra cost.

All standards and specifications which are recommended to facilitate the disabled and the aging will be of benefit to everyone. The standards referred to herein can be incorporated in any type of building regardless of the basic architectural concept.

1. Scope and Purpose

1.1 Scope

1.1.1 This standard applies to all buildings and facilities used by the public. It applies to temporary or emergency conditions as well as permanent conditions. It does not apply to private residences.

1.1.2 This standard is concerned with nonambulatory disabilities, semiambulatory disabilities, sight disabilities, hearing disabilities, disabilities of incoordination, and aging.[1]

1.2 Purpose. This standard is intended to make all buildings and facilities used by the public accessible to, and functional for, the physically handicapped, to, through, and within their doors, without loss of function, space, or facility where the general public is concerned. It supplements existing American Standards, and reflects great concern for safety of life and limb. In cases of practical difficulty, unnecessary hardship, or extreme differences, administrative authorities may grant exceptions from the literal requirements of this standard or permit the use of other methods or materials, but only when it is clearly evident that equivalent facilitation and protection are thereby secured.

2. Definitions

2.1 Nonambulatory Disabilities. Impairments that, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

2.2 Semiambulatory Disabilities. Impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastics, and those with pulmonary and cardiac ills may be semiambulatory.

2.3 Sight Disabilities. Total blindness or impairments affecting sight to the extent that the individual functioning in public areas is insecure or exposed to danger.

2.4 Hearing Disabilities. Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

2.5 Disabilities of Incoordination. Faulty coordination or palsy from brain, spinal, or peripheral nerve injury.

2.6 Aging. Those manifestations of the aging process that significantly reduce mobility, flexibility, coordination, and perceptiveness but are not accounted for in the aforementioned categories.

2.7 Standard. When this term appears in small letters and is not preceded by the word "American," it is descriptive and does not refer to an American Standard approved by ASA; for example, a "standard" wheelchair is one characterized as standard by the manufacturers.

2.8 Fixed Turning Radius, Wheel to Wheel. The tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot.

2.9 Fixed Turning Radius, Front Structure to Rear Structure. The turning radius of a wheelchair, left front-foot platform to right rear wheel, or right front-foot platform to left rear wheel, when pivoting on a spot.

2.10 Involved (Involvement). A portion or portions of the human anatomy or physiology, or both, that have a loss or impairment of normal function as a result of genesis, trauma, disease, inflammation, or degeneration.

2.11 Ramps, Ramps with Gradients. Because the term "ramp" has a multitude of meanings and uses, its use in this text is clearly defined as ramps with gradients (or ramps with slopes) that deviate from what would otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

2.12 Walk, Walks. Because the terms "walk" and "walks" have a multitude of meanings and uses, their use in this text is clearly defined as a predetermined, prepared-surface, exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level and not deviating from the level of the existing ground immediately adjacent.

2.13 Appropriate Number. As used in this text, appropriate number means the number of a specific item that would be necessary, in accord with the purpose and function of a building or facility, to accommodate individuals with specific disabilities in proportion to the anticipated number of individuals with disabilities who would use a particular building or facility.

EXAMPLE: Although these specifications shall apply to all buildings and facilities used by the public, the numerical need for a specific item would differ, for example, between a major transportation terminal, where many individuals with diverse disabilities would be continually coming and going, an office building or factory, where varying numbers of individuals with disabilities of varying manifestations (in many instances, very large numbers) might be employed or have reason for frequent visits, a school or church, where the number of individuals may be fixed and activities more definitive, and the many other buildings and facilities dedicated to specific functions and purposes.

NOTE: Disabilities are specific and where the individual has been properly evaluated and properly oriented and where architectural barriers have been eliminated, a specific disability does not constitute a handicap. It should be emphasized that more and more of those physically disabled are becoming participants rather than spectators, in the fullest meaning of the word.

3. General Principles and Considerations

3.1 Wheelchair Specifications. The collapsible-model wheelchair of tubular metal construction with plastic upholstery for back and seat is most commonly use. The standard model of all manufacturers falls within the following limits, which were used as the basis of consideration:

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[1] See definitions in Section 2.

(1) Length: 42 inches
(2) Width, when open: 25 inches
(3) Height of seat from floor: 19½ inches
(4) Height of armrest from floor: 29 inches
(5) Height of pusher handles (rear) from floor: 36 inches
(6) Width, when collapsed: 11 inches

3.2 The Functioning of a Wheelchair

3.2.1 The fixed turning radius of a standard wheelchair, wheel to wheel, is 18 inches. The fixed turning radius, front structure to rear structure, is 31.5 inches.

3.2.2 The average turning space required (180 and 360 degrees) is 60 x 60 inches.

NOTE: Actually, a turning space that is longer than it is wide, specifically, 63 x 56 inches, is more workable and desirable. In an area with two open ends, such as might be the case in a corridor, a minimum of 54 inches between two walls would permit a 360-degree turn.

3.2.3 A minimum width of 60 inches is required for two individuals in wheelchairs to pass each other.

3.3 The Adult Individual Functioning in a Wheelchair [2]

3.3.1 The average unilateral vertical reach is 60 inches and ranges from 54 inches to 78 inches.

3.3.2 The average horizontal working (table) reach is 30.8 inches and ranges from 28.5 inches to 33.2 inches.

3.3.3 The bilateral horizontal reach, both arms extended to each side, shoulder high, ranges from 54 inches to 71 inches and averages 64.5 inches.

3.3.4 An individual reaching diagonally, as would be required in using a wall-mounted dial telephone or towel dispenser, would make the average reach (on the wall) 48 inches from the floor.

3.4 The Individual Functioning on Crutches [3]

3.4.1 On the average, individuals 5 feet 6 inches tall require an average of 31 inches between crutch tips in the normally accepted gaits.[4]

3.4.2 On the average, individuals 6 feet 0 inches tall require an average of 32.5 inches between crutch tips in the normally accepted gaits.[4]

4. Site Development [5]

4.1 Grading. The grading of ground, even contrary to existing topography, so that it attains a level with a normal entrance will make a facility accessible to individuals with physical disabilities.

4.2 Walks

4.2.1 Public walks should be at least 48 inches wide and should have a gradient not greater than 5 percent.[6]

4.2.2 Such walks should be of a continuing common surface, not interrupted by steps or abrupt changes in level.

4.2.3 Wherever walks cross other walks, driveways, or parking lots they should blend to a common level.[7]

NOTE: 4.1 and 4.2, separately or collectively, are greatly aided by terracing, retaining walls, and winding walks allowing for more gradual incline, thereby making almost any building accessible to individuals with permanent physical disabilites, while contributing to its esthetic qualities.

4.2.4 A walk should have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

4.2.5 A walk shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

4.3 Parking Lots

4.3.1 Spaces that are accessible and approximate to the facility should be set aside and identified for use by individuals with physical disabilities.

4.3.2 A parking space open on one side, allowing room for individuals in wheelchairs or individuals on braces and crutches to get in and out of an automobile onto a level surface, suitable for wheeling and walking, is adequate.

4.3.3 Parking spaces for individuals with physical disabilities when placed between two conventional diagonal or head-on parking spaces should be 12 feet wide.

4.3.4 Care in planning should be exercised so that individuals in wheelchairs and individuals using braces and crutches are not compelled to wheel or walk behind parked cars.

4.3.5 Consideration should be given to the distribution of spaces for use by the disabled in accordance with the frequency and persistency of parking needs.

4.3.6 Walks should be in conformity with 4.2.

5. Buildings

5.1 Ramps with Gradients. Where ramps with gradients are necessary or desired, they shall conform to the following specifications:

5.1.1 A ramp shall not have a slope greater than 1 foot rise in 12 feet, or 8.33 percent, or 4 degrees 50 minutes.

5.1.2 A ramp shall have handrails on at least one side, and preferably two sides, that are 32 inches in height, measured from the surface of the ramp, that are smooth, that extend 1 foot beyond the top and bottom of the ramp, and that otherwise conform with American Standard Safety Code for Floor and Wall Openings, Railings, and Toe Boards, A-12-1932.

NOTE 1: Where codes specify handrails to be of heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where major traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails, in accordance with the nature of the facility and the age group or groups being serviced.

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[2] Extremely small, large, strong, or weak and involved individuals could fall outside the ranges in 3.3.1, 3.3.2, 3.3.3, and their reach could differ from the figure given in 3.3.4. However, these reaches were determined using a large number of individuals who were functionally trained, with a wide range in individual size and involvement.

[3] Most individuals ambulating on braces or crutches, or both, or on canes are able to manipulate within the specifications prescribed for wheelchairs, although doors present quite a problem at times. However, attention is called to the fact that a crutch tip extending laterally from an individual is not obvious to others in heavily trafficked areas, certainly not as obvious or protective as a wheelchair and is, therefore, a source of vulnerability.

[4] Some cerebral palsied individuals, and some severe arthritics, would be extreme exceptions to 3.4.1 and 3.4.2.

[5] Site development is the most effective means to resolve the problems created by topography, definitive architectural designs or concepts, water table, existing streets, and atypical problems, singularly or collectively, so that aggress, ingress, and egress to buildings by physically disabled can be facilitated while preserving the desired design and effect of the architecture.

[6] It is essential that the gradient of walks and driveways be less than that prescribed for ramps, since walks would be void of handrails and curbs and would be considerably longer and more vulnerable to the elements. Walks of near maximum grade and considerable length should have level areas at intervals for purposes of rest and safety. Walks or driveways should have a nonslip surface.

[7] This specification does not require the elimination of curbs, which, particularly if they occur at regular intersections, are a distinct safety feature for all of the handicapped, particularly the blind. The preferred method of meeting the specifications is to have the walk incline to the level of the street. However, at principal intersections, it is vitally important that the curb run parallel to the street, up to the point where the walk is inclined, at which point the curb would turn in and gradually meet the level of the walk at its highest point. A less preferred method would be to gradually bring the surface of the driveway or street to the level of the walk. The disadvantage of this method is that a blind person would not know when he has left the protection of a walk and entered the hazards of a street or driveway.

NOTE 2: Care should be taken that the extension of the handrail is not in itself a hazard. The extension may be made on the side of a continuing wall.

5.1.3 A ramp shall have a surface that is nonslip.

5.1.4 A ramp shall have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

5.1.5 A ramp shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

5.1.6 Each ramp shall have at least 6 feet of straight clearance at the bottom.

5.1.7 Ramps shall have level platforms at 30-foot intervals for purposes of rest and safety and shall have level platforms wherever they turn.

5.2 Entrances

5.2.1 At least one primary entrance to each building shall be usable by individuals in wheelchairs.

NOTE: Because entrances also serve as exits, some being particularly important in case of an emergency, and because the proximity of such exits to all parts of buildings and facilities, in accordance with their design and function, is essential (see 112 and 2000 through 2031 of American Standard Building Exits Code, A9.1-1953) it is preferable that all or most entrances (exits) should be accessible to, and usable by, individuals in wheelchairs and individuals with other forms of physical disability herein applicable.

5.2.2 At least one entrance usable by individuals in wheelchairs shall be on a level that would make the elevators accessible.

5.3 Doors and Doorways

5.3.1 Doors shall have a clear opening of no less than 32 inches when open and shall be operable by a single effort.

NOTE 1: Two-leaf doors are not usable by those with disabilities defined in 2.1, 2.2, and 2.5 unless they operate by a single effort, or unless one of the two leaves meets the requirement of 5.3.1.

NOTE 2: It is recommended that all doors have kick plates extending from the bottom of the door to at least 16 inches from the floor, or be made of a material and finish that would safely withstand the abuse they might receive from canes, crutches, wheelchair foot-platforms, or wheelchair wheels.

5.3.2 The floor on the inside and outside of each doorway shall be level for a distance of 5 feet from the door in the direction the door swings and shall extend 1 foot beyond each side of the door.

5.3.3 Sharp inclines and abrupt changes in level shall be avoided at doorsills. As much as possible, thresholds shall be flush with the floor.

NOTE 1: Care should be taken in the selection, placement, and setting of door closers so that they do not prevent the use of doors by the physically disabled. Time-delay door closers are recommended.

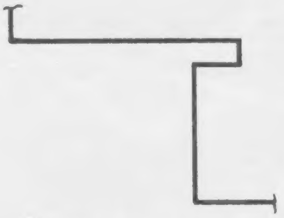
NOTE 2: Automatic doors that otherwise conform to 5.3.1, 5.3.2, and 5.3.3 are very satisfactory.

NOTE 3: These specifications apply both to exterior and interior doors and doorways.

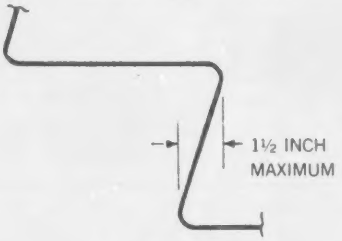
5.4 Stairs. Stairs shall conform to American Standard A9.1-1953, with the following additional considerations:

5.4.1 Steps in stairs that might require use by those with disabilities defined in 2.2 and 2.5 or by the aged shall not have abrupt (square) nosing (see Figure 1).

NOTE: Individuals with restrictions in the knee, ankle, or hip, with artificial legs, long leg braces, or comparable conditions cannot, without great difficulty and hazard, use steps with nosing as illustrated in Fig. 1a, but can safely and with minimum difficulty use steps with nosing as illustrated in Fig. 1b.



A. UNACCEPTABLE



B. ACCEPTABLE

Figure 1. Steps.

5.4.2 Stairs shall have handrails 32 inches high as measured from the tread at the face of the riser.

NOTE: Where codes specify handrails to be at heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails in accordance with the nature of the facility and the age group or groups being serviced. Dual handrails may be necessary.

5.4.3 Stairs shall have at least one handrail that extends at least 18 inches beyond the top step and beyond the bottom step.

NOTE: Care should be taken that the extension of the handrails is not in itself a hazard. The extension may be made on the side of a continuing wall.

5.4.4 Steps should, wherever possible, and in conformation with existing step formulas, have risers that do not exceed 7 inches.

5.5 Floors

5.5.1 Floors shall have a surface that is nonslip.

5.5.2 Floors on a given story shall be of a common level throughout or be connected by a ramp in accord with 5.1.1 through 5.1.6, inclusive.

EXAMPLE 1: There shall not be a difference between the level of the floor of a corridor and the level of the floor of the toilet rooms.

EXAMPLE 2: There should not be a difference between the level of the floor of a corridor and the level of a meeting room, dining room, or any other room, unless proper ramps are provided.

5.6 Toilet Rooms. It is essential that an appropriate number[8] of toilet rooms, in accordance with the nature and use of a specific building or facility, be made accessible to, and usable by, the physically handicapped.

5.6.1 Toilet rooms shall have space to allow traffic of individuals in wheelchairs, in accordance with 3.1, 3.2, and 3.3 (see Figure 2).

5.6.2 Toilet rooms shall have at least one toilet stall that—

(1) Is 3 feet wide
(2) Is at least 4 feet 8 inches, preferably 5 feet, deep
(3) Has a door (where doors are used) that is 32 inches wide and swings out

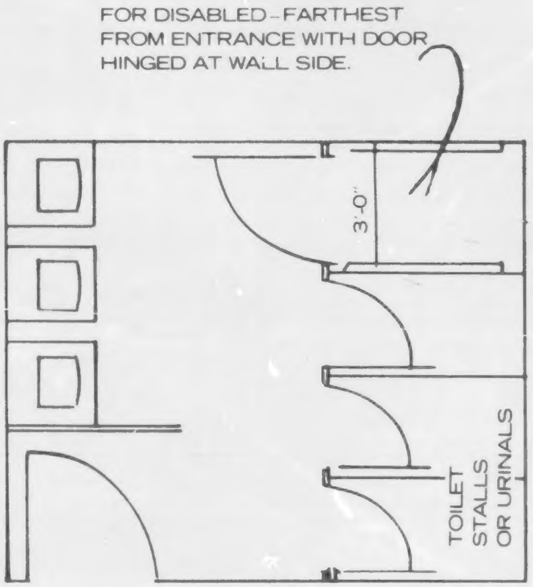

FOR DISABLED-FARTHEST FROM ENTRANCE WITH DOOR HINGED AT WALL SIDE.
3'-0"
TOILET STALLS OR URINALS

Figure 2. Suggested Placement of Wide Stall with Outswinging Door in Toilet Room.

(4) Has handrails on each side, 33 inches high and parallel to the floor, 1½ inches in outside diameter, with 1½ inches clearance between rail and wall, and fastened securely at ends and center.

(5) Has a water closet with the seat 20 inches from the floor (see Figure 3).

NOTE: The design and mounting of the water closet is of considerable importance. A wall-mounted water closet with a narrow understructure that recedes sharply is most desirable. If a floor-mounted water closet must be used, it should not have a front that is wide and perpendicular to the floor at the front of the seat. The bowl should be shallow at the front of the seat and turn backward more than downward to allow the individual in a wheelchair to get close to the water closet with the seat of the wheelchair.

5.6.3 Toilet rooms shall have lavatories with narrow aprons, which when mounted at standard height are usable by individuals in wheelchairs; or shall have lavatories mounted higher, when particular designs demand, so that they are usable by individuals in wheelchairs.

NOTE: It is important that drain pipes and hot-water pipes under a lavatory be covered or insulated so that a wheelchair individual without sensation will not burn himself.

5.6.4 Some mirrors and shelves shall be provided above lavatories at a height as low as possible and no higher than 40 inches above the floor, measured from the top of the shelf and the bottom of the mirror.

5.6.5 Toilet rooms for men shall have wall-mounted urinals with the opening of the basin 19 inches from the floor (see Figure 4), or shall have floor-mounted urinals that are on a level with the main floor of the toilet room.

5.6.6 Toilet rooms shall have an appropriate number[a] of towel racks, towel dispensers, and other dispensers and disposal units mounted no higher than 40 inches from the floor.

5.7 Water Fountains. An appropriate number[a] of water fountains or other water-dispensing means shall be accessible to, and usable by, the physically disabled (see Figure 5).

5.7.1 Water fountains or coolers shall have up-front spouts and controls.

5.7.2 Water fountains or coolers shall be hand-operated or hand- and foot-operated. (See also American Standard Specifications for Drinking Fountains, Z4.2-1942.)

NOTE 1: Conventional floor-mounted water coolers can be serviceable to individuals in wheelchairs if a small fountain is mounted on the side of the cooler 30 inches above the floor.

NOTE 2: Wall-mounted, hand-operated coolers of the latest design, manufactured by many companies, can serve the able-bodied and the physically disabled equally well when the cooler is mounted with the basin 36 inches from the floor.

NOTE 3: Fully recessed water fountains are not recommended.

NOTE 4: Water fountains should not be set into an alcove unless the alcove is wider than a wheelchair. (See 3.1.)

5.8 Public Telephones. An appropriate number[a] of public telephones should be made accessible to, and usable by, the physically disabled (see Figure 6).

NOTE: The conventional public telephone booth is not usable by most physically disabled individuals. There are many ways in which public telephones can be made accessible and usable. It is recommended that architects and builders confer with the telephone company in the planning of the building or facility.

5.8.1 Such telephones should be placed so that the dial and the handset can be reached by individuals in wheelchairs, in accordance with 3.3.

5.8.2 An appropriate number[a] of public telephones should be equipped for those with hearing disabilities and so identified with instructions for use.

NOTE: Such telephones can be used by everyone.

5.9 Elevators. In a multiple-story building, elevators are essential to the successful functioning of physically disabled individuals. They shall conform to the following requirements:

5.9.1 Elevators shall be accessible to, and usable by, the physically disabled on the level that they use to enter the building, and at all levels normally used by the general public.

5.9.2 Elevators shall allow for traffic by wheelchair, in accordance with 3.1, 3.2, 3.3 and 5.3.

5.10 Controls. Switches and controls for light, heat, ventilation, windows, draperies, fire alarms, and all similar controls of frequent or essential use shall be placed within the reach of individuals in wheelchairs. (See 3.3.)

5.11 Identification. Appropriate identification of specific facilities within a building used by the public is particularly essential to the blind.

5.11.1 Raised letters or numbers shall be used to identify rooms or offices.

5.11.2 Such identification should be placed on the wall, to the right or left of the door, at a height between 4 feet 6 inches and 5 feet 6 inches, measured from the floor, and preferably at 5 feet.

5.11.3 Doors that are not intended for normal use, and that might prove dangerous if a blind person were to exit or enter by them, should be made quickly identifiable to the touch by knurling on the door handle or knob. (See Fig. 4.)

NOTE: Knurling can be imposed upon door handles or knobs by use of textured plastic.

EXAMPLE: Such doors might lead to loading platforms, boiler rooms, stages, fire escapes, etc.

5.12 Warning Signals

5.12.1 Audible warning signals shall be accompanied by simultaneous visual signals for the benefit of those with hearing disabilities.

5.12.2 Visual signals shall be accompanied by simultaneous audible signals for the benefit of the blind.

5.13 Hazards. Every effort shall be exercised to obviate hazards to individuals with physical disabilities.

---

[a] See 2.13.

5.13.1 Access panels or manholes in floors, walks, and walls can be extremely hazardous, particularly when in use, and should be avoided.

5.13.2 When manholes or access panels are open and in use, or when an open excavation exists on a site, particularly when it is approximate to normal pedestrian traffic, barricades shall be placed on all open sides, at least 8 feet from the hazard, and warning devices shall be installed in accord with 5.12.2.

5.13.3 Low-hanging door closers that remain within the opening of a doorway when the door is open, or that protrude hazardously into regular corridors or traffic ways when the door is closed, shall be avoided.

5.13.4 Low-hanging signs, ceiling lights, and similar objects or signs and fixtures that protrude into regular corridors or traffic ways shall be avoided. A minimum height of 7 feet, measured from the floor, is recommended.

5.13.5 Lighting on ramps shall be in accord with 1201, 1202, 1203, and 1204 of American Standard AD.1-1953.

5.13.6 Exit signs shall be in accord with 1205 of American Standard A9.1-1953, except as modified by 5.11 of this standard.

For adaptations of shower facilities for the disabled, see Figures 8-12.

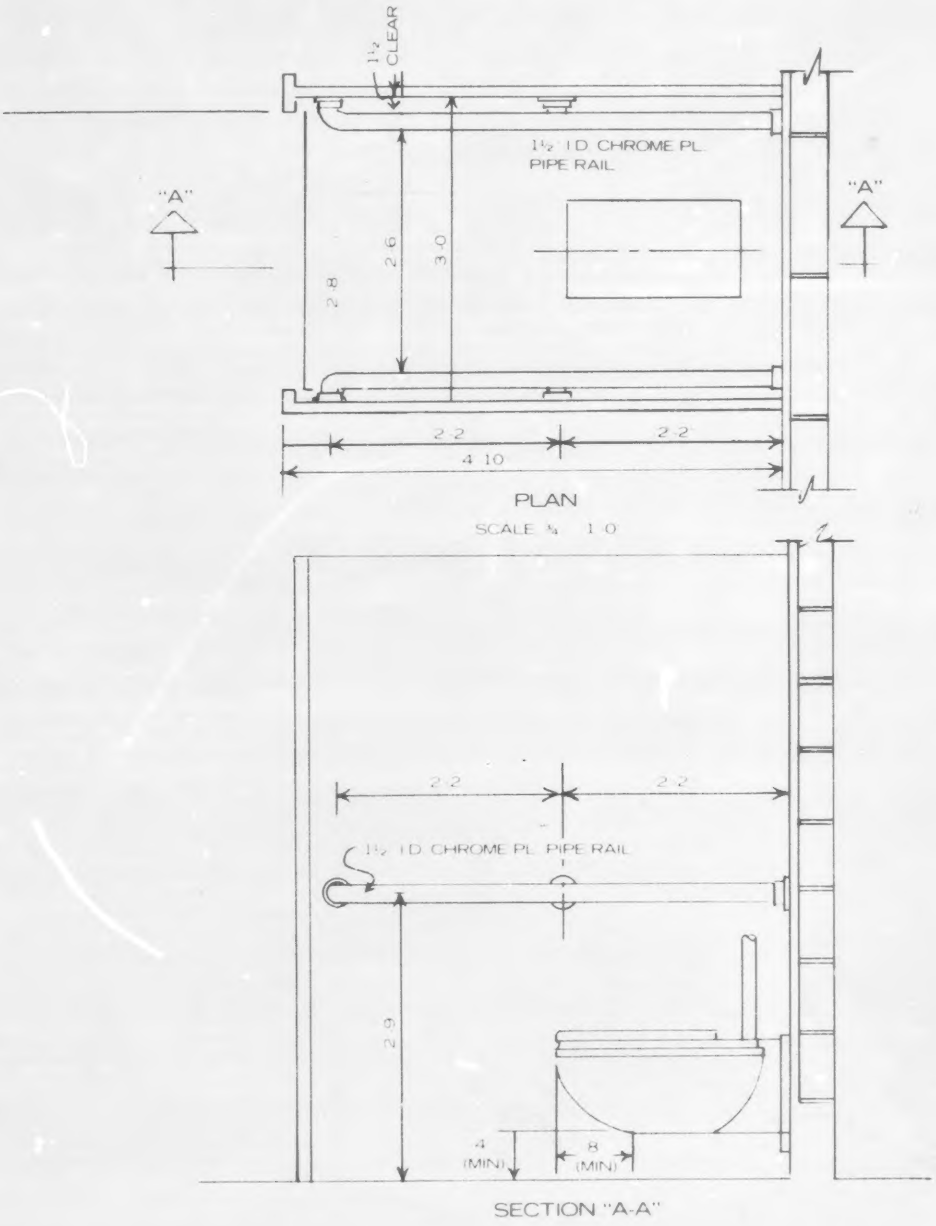


Figure 3. Standard Paraplegic Toilet Stall.

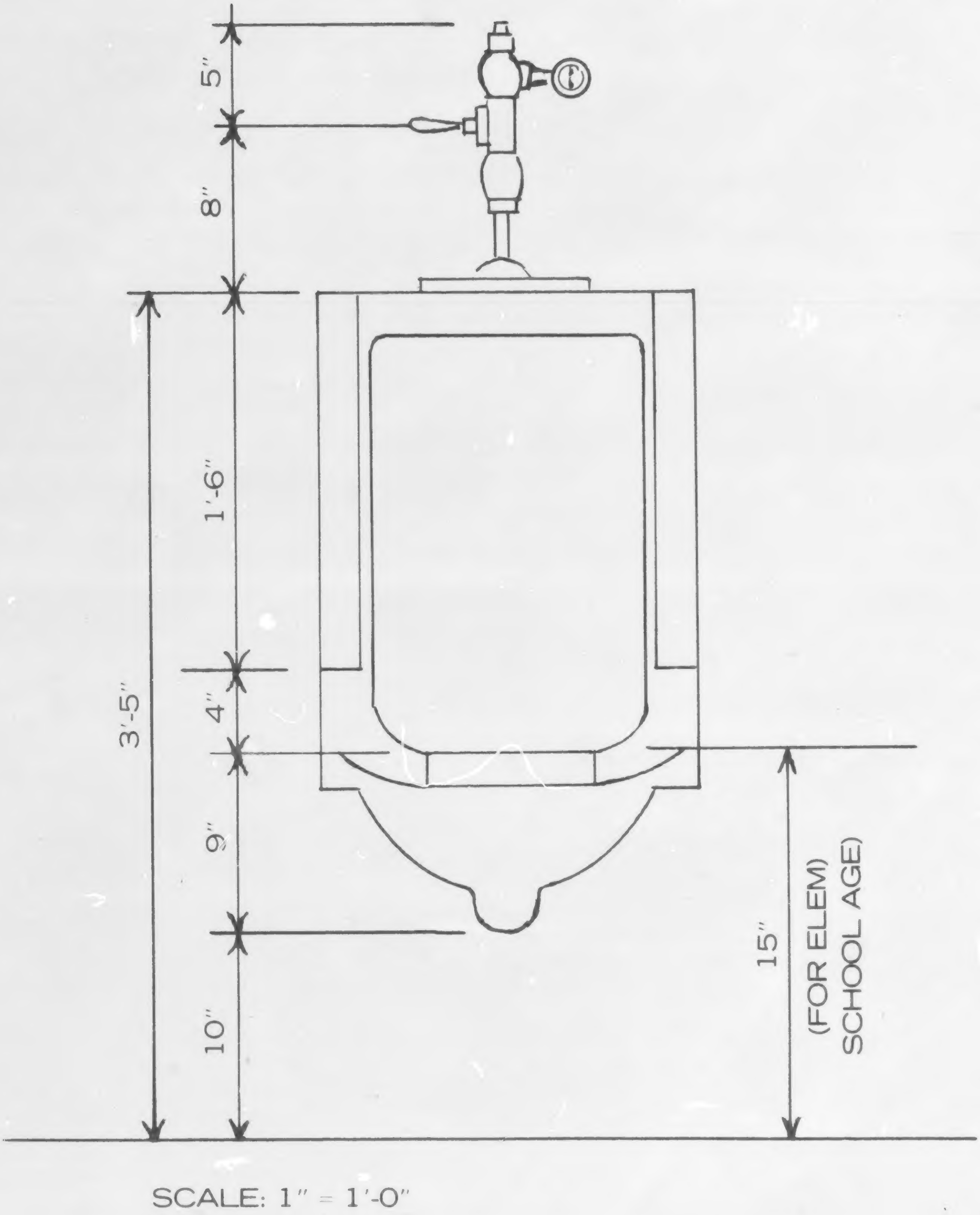

5"
8"
1'-6"
4"
9"
10"
3'-5"
15"
(FOR ELEM)
SCHOOL AGE)
SCALE: 1" = 1'-0"

Figure 4. Wall - Mounted Urinal.

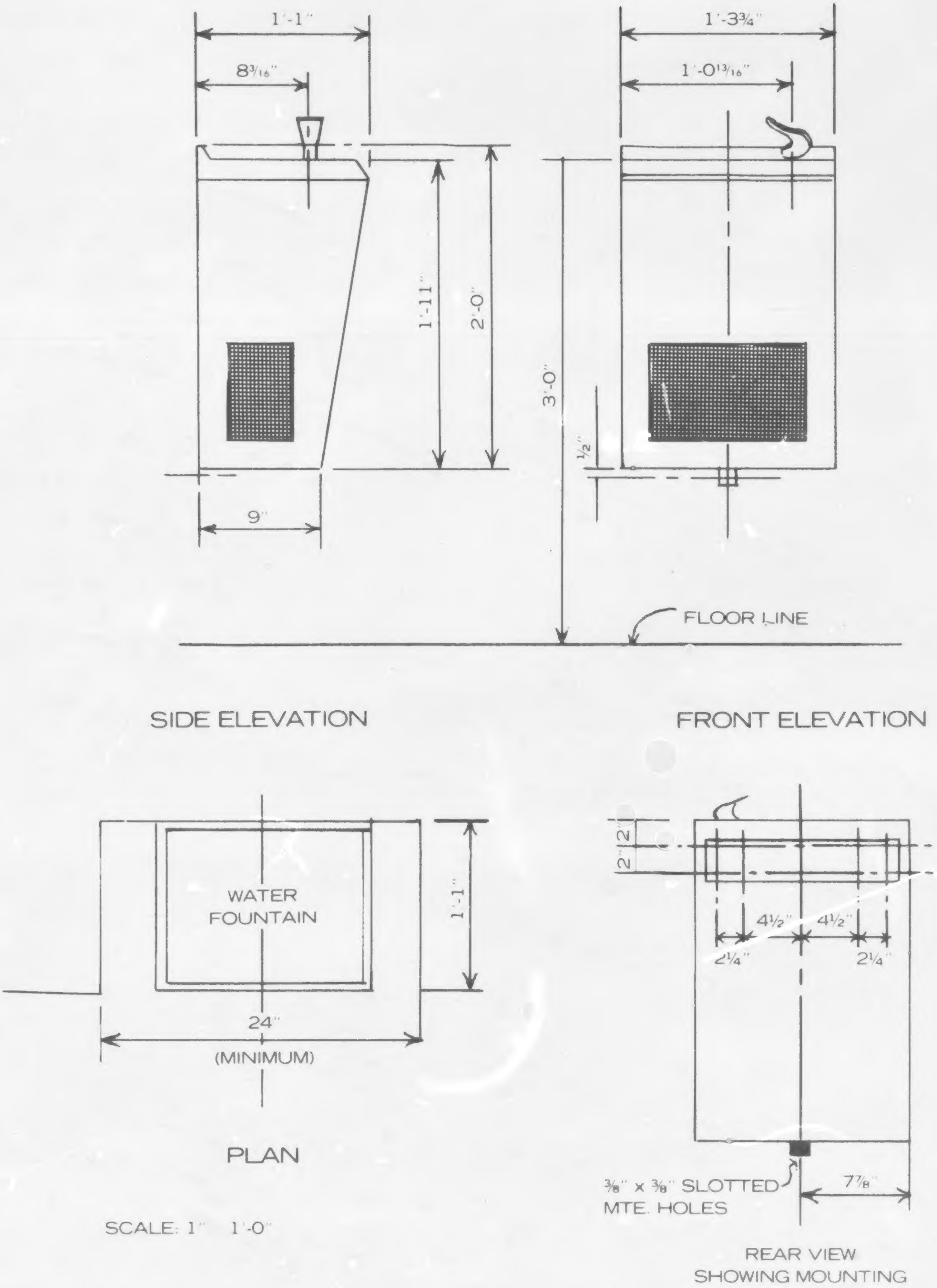

1'-1"
8³⁄₁₆"
1'-11"
2'-0"
9"
1'-3¾"
1'-0¹³⁄₁₆"
3'-0"
½"
FLOOR LINE
SIDE ELEVATION
FRONT ELEVATION
WATER FOUNTAIN
1'-1"
24"
(MINIMUM)
PLAN
SCALE: 1"   1'-0"
2"
2"
4½"
4½"
2¼"
2¼"
⅜" x ⅜" SLOTTED MTE. HOLES
7⅞"
REAR VIEW SHOWING MOUNTING

Figure 5. Water Fountain—Recessed in Wall

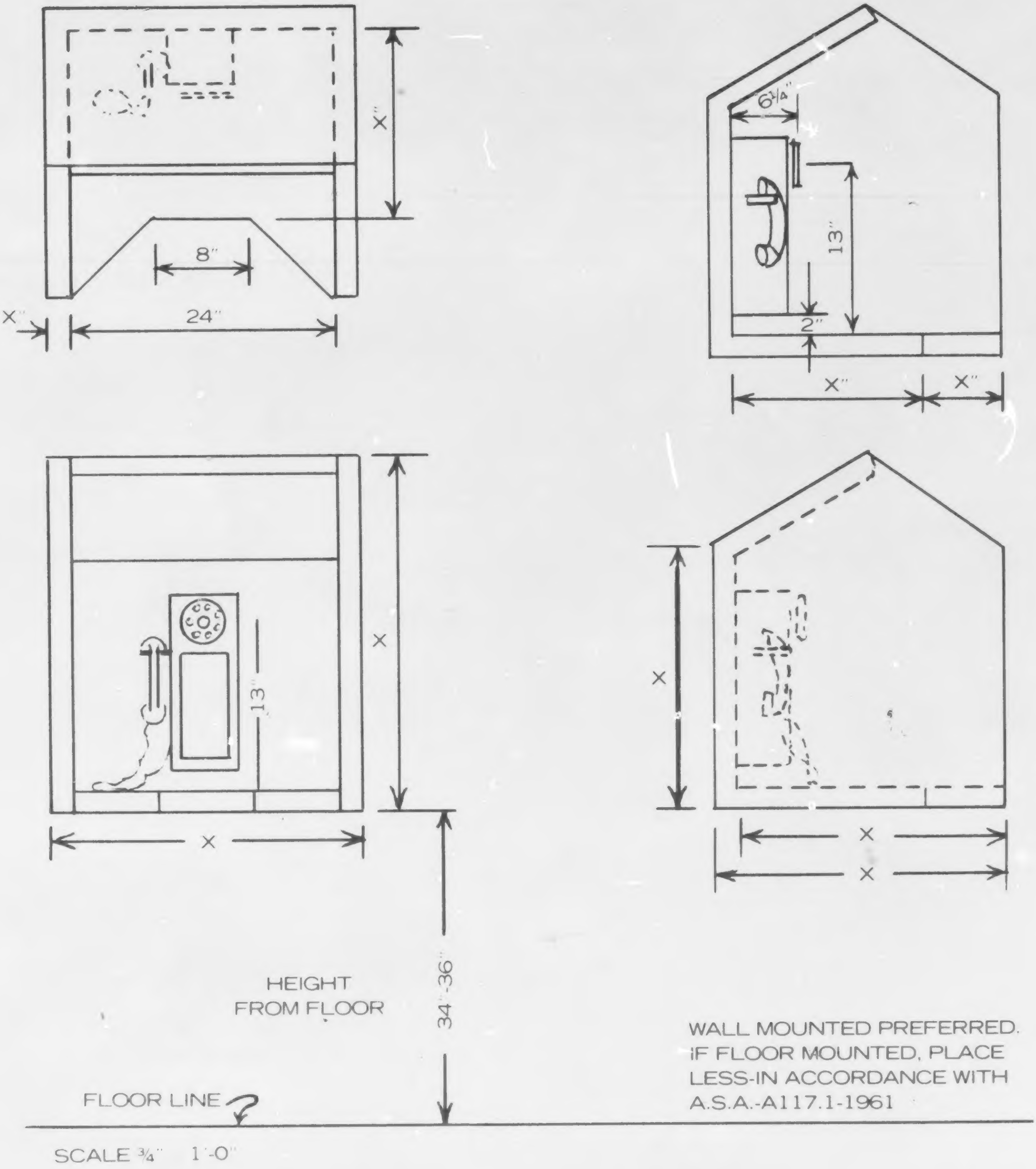

X"
8"
X"
24"
6¼"
13"
2"
X"
X"
X
13"
X
X
X
X
HEIGHT
FROM FLOOR
34"-36"
FLOOR LINE
WALL MOUNTED PREFERRED.
IF FLOOR MOUNTED, PLACE
LESS-IN ACCORDANCE WITH
A.S.A.-A117.1-1961
SCALE ¾" 1'-0"

Figure 6. Plan of Placement of Modern Telephones to be Equally Usable by Able, Disabled and Smaller Children.

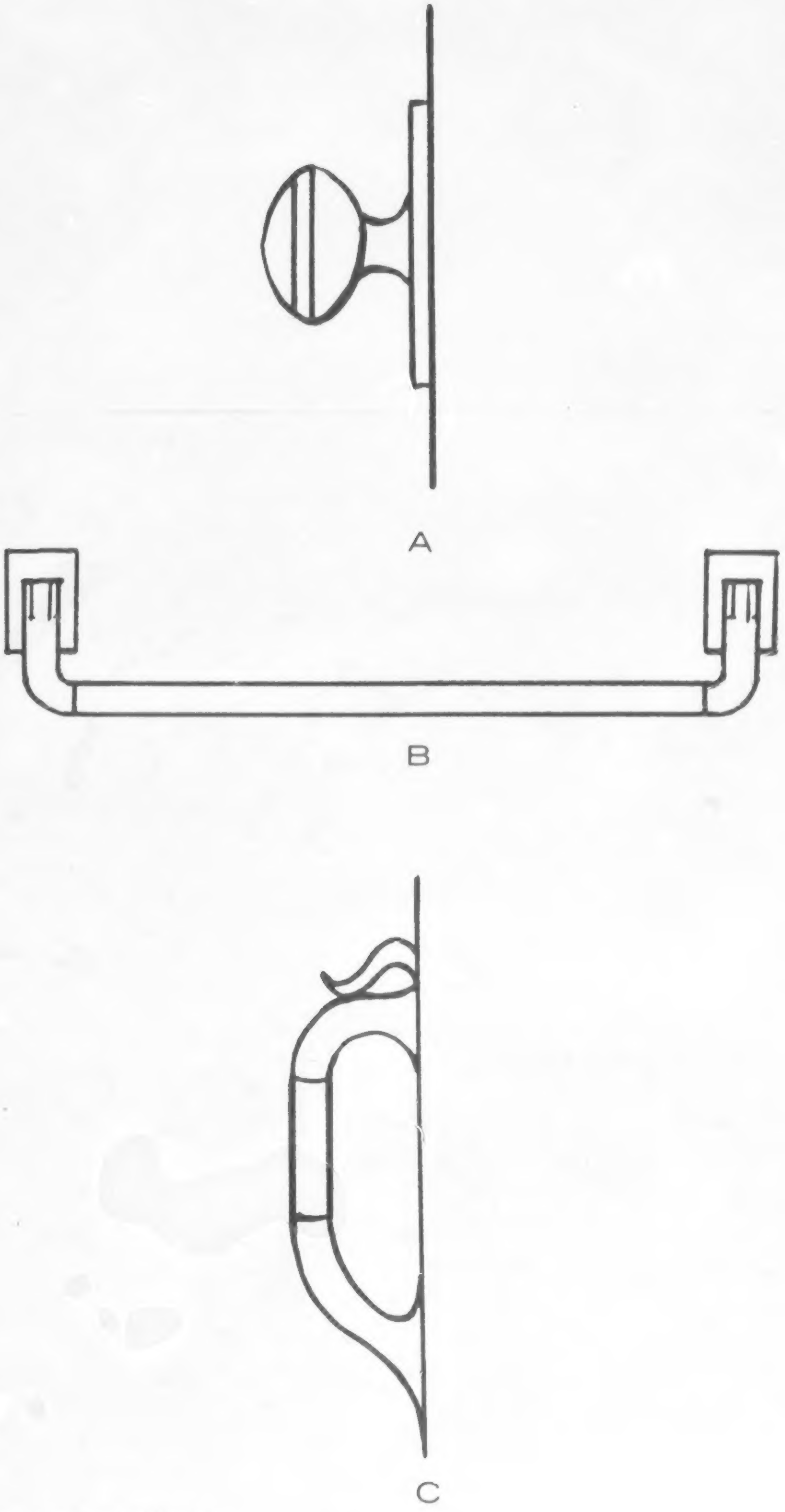
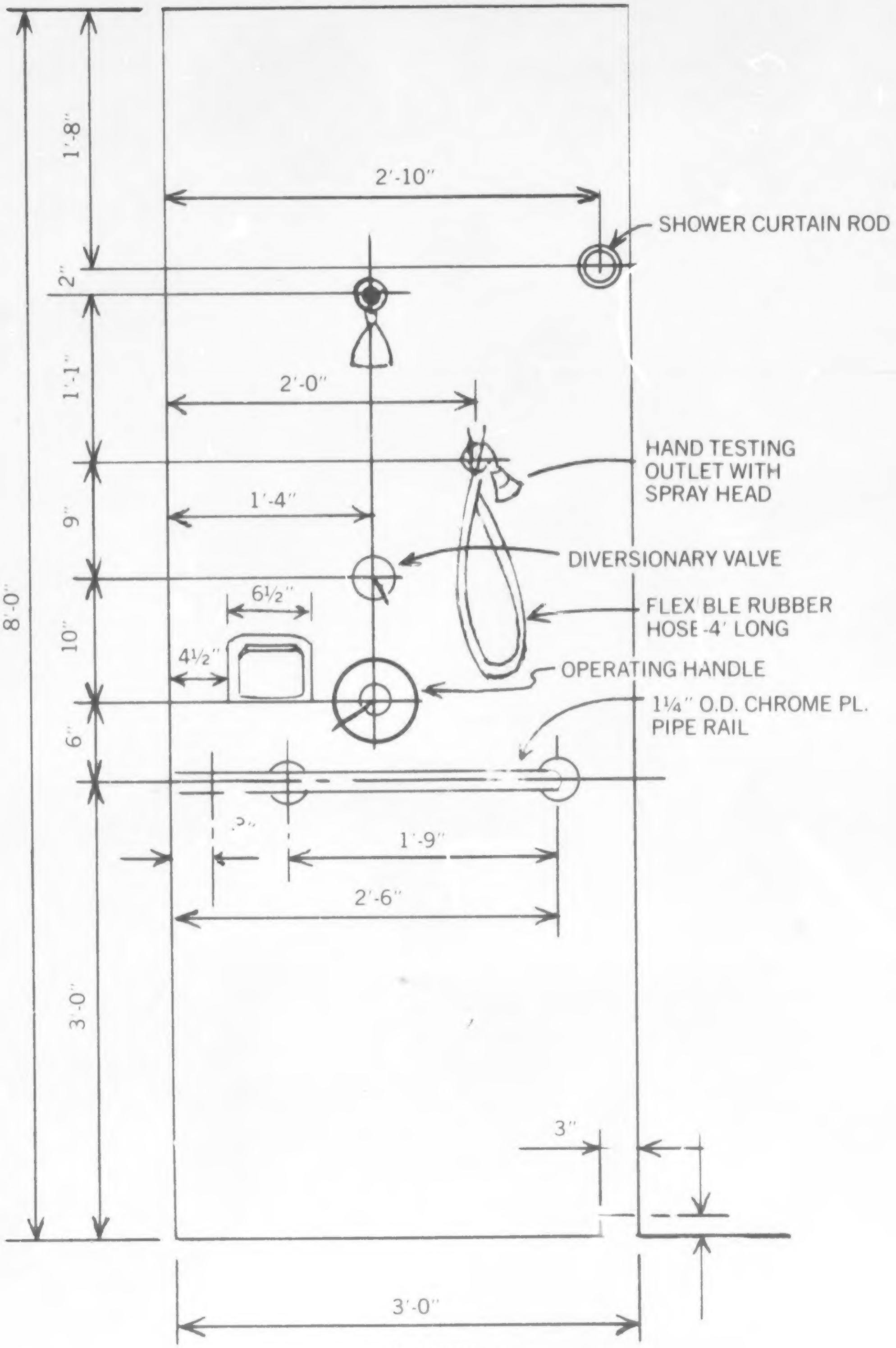


Figure 7. Knurled Door Handles and Knobs.


8'-0"
1'-8"
2"
1'-1"
9"
10"
6"
3'-0"
2'-10"
SHOWER CURTAIN ROD
2'-0"
HAND TESTING OUTLET WITH SPRAY HEAD
1'-4"
DIVERSIONARY VALVE
6½"
FLEXIBLE RUBBER HOSE-4' LONG
4½"
OPERATING HANDLE
1¼" O.D. CHROME PL. PIPE RAIL
1'-9"
2'-6"
3"
3'-0"

PLUMBING WALL
SCALE: ¾" = 1'-0"

Figure 8. Shower Facilities.

RECOMMENDED FACILITY ADAPTATIONS
FOR THE AGING AND THE DISABLED

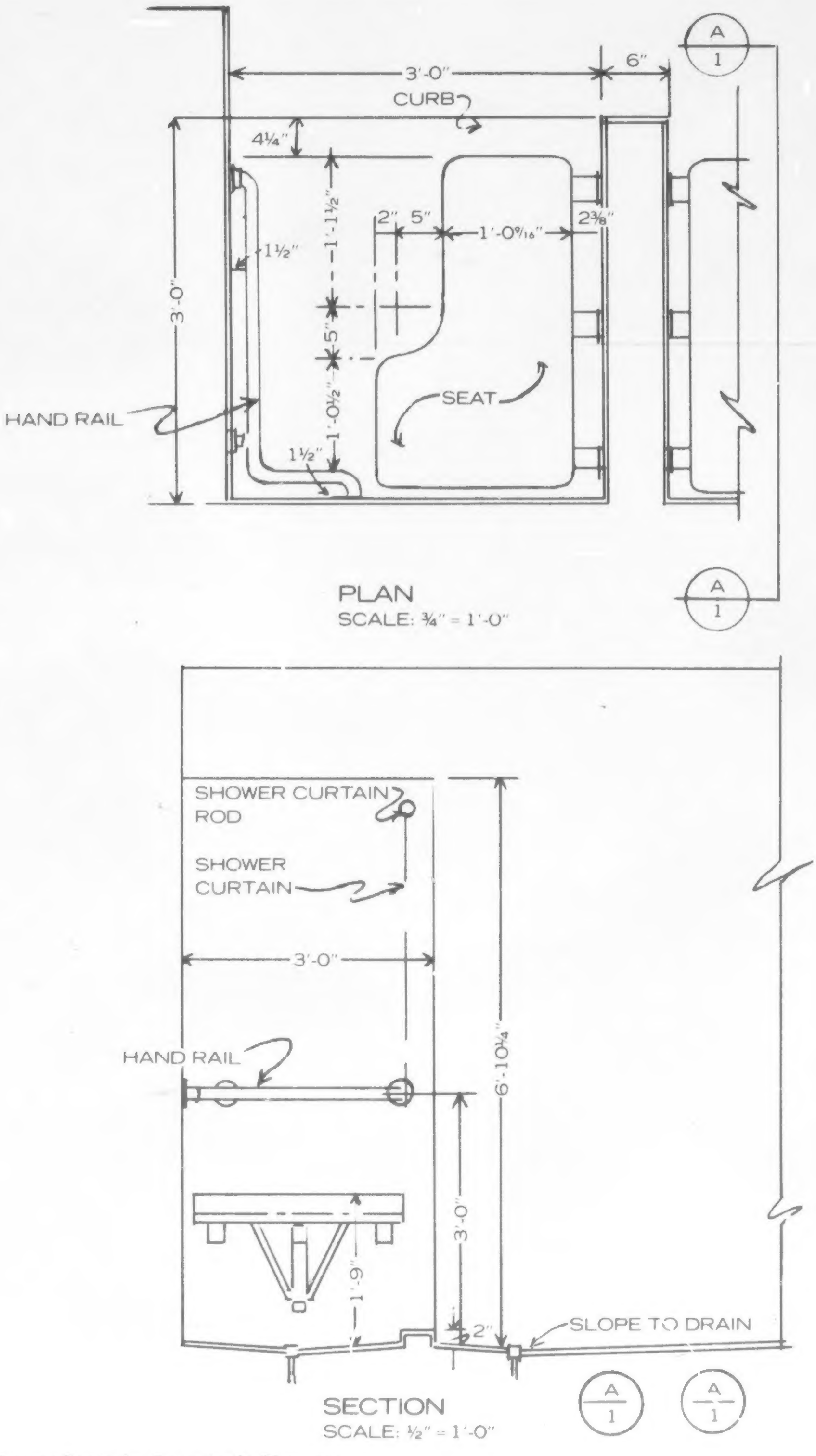
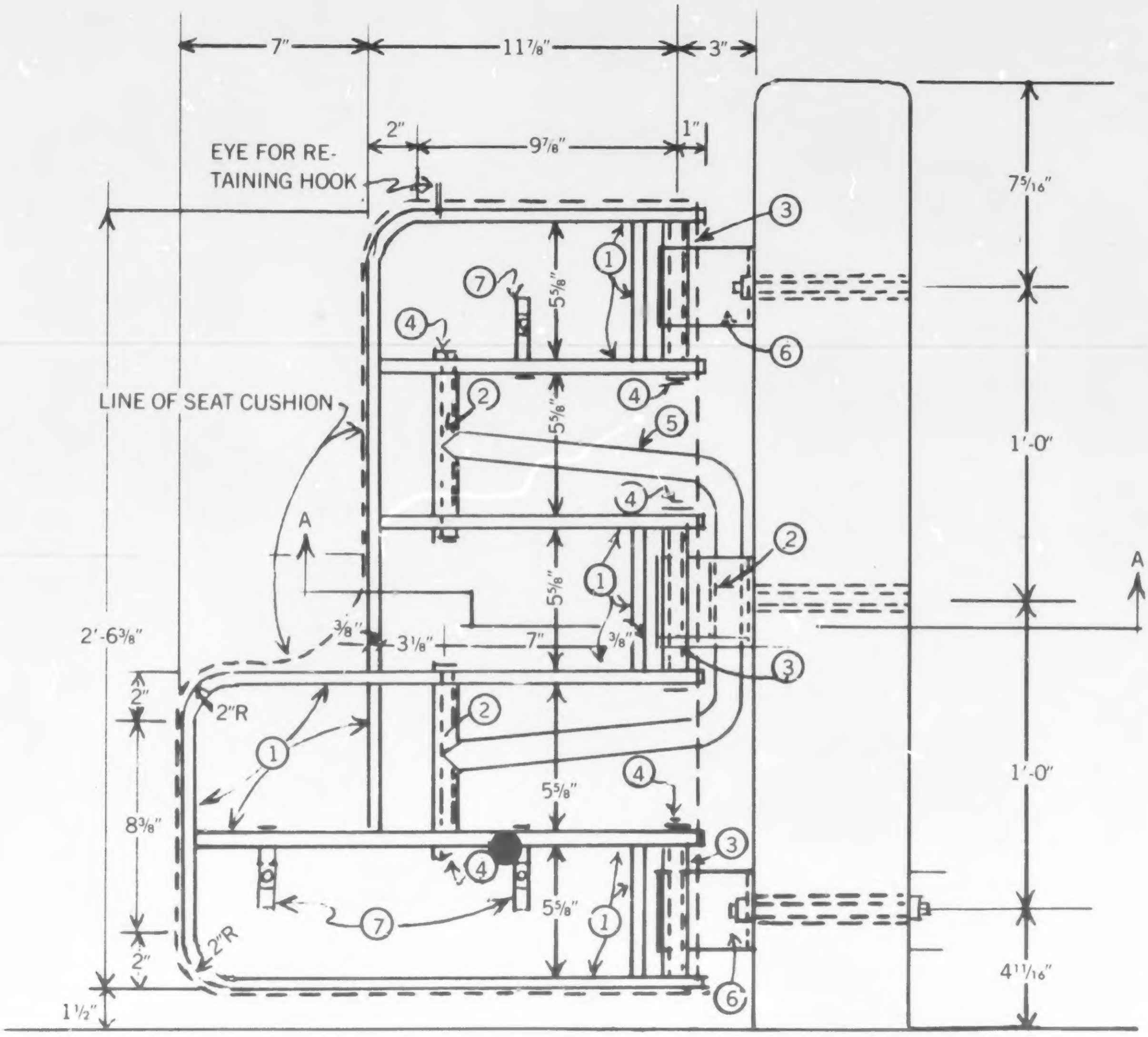

A 1
3'-0"
6"
CURB
4¼"
1'-1½"
2"
5"
1'-0⁹⁄₁₆"
2⅜"
1½"
3'-0"
5"
1'-0½"
SEAT
HAND RAIL
1½"
A 1
PLAN
SCALE: ¾" = 1'-0"
SHOWER CURTAIN ROD
SHOWER CURTAIN
3'-0"
6'-10¼"
HAND RAIL
3'-0"
1'-9"
2"
SLOPE TO DRAIN
SECTION
SCALE: ½" = 1'-0"
A 1
A 1

Figure 9. Folding Shower Seats for Paraplegic Showers.


7"
11⅞"
3"
2"
9⅞"
1"
EYE FOR RE-
TAINING HOOK
7 5/16"
1'-0"
1'-0"
4 11/16"
LINE OF SEAT CUSHION
A
A
2'-6⅜"
⅜"
3⅛"
7"
⅜"
5⅝"
5⅝"
5⅝"
5⅝"
5⅝"
2"
2"R
8⅜"
2"
2"R
1½"
①
②
③
④
⑤
⑥
⑦

PLAN

SCALE: 1½"=1'-0"

KEY

1 – ⅜" X 1¼" FLAT BAR ALUMINUM ALLOY – SHAPE SHOWN.
2 – SEAT BRACKET AND GUIDE – S.S. – SEE DETAIL.
3 – 1" O.D. TUBING – .203" THICK – S.S. – ALLOW CLEARANCE. WELD TO 6.
4 – ½" ϕ BOLTS – S.S. – 8" LONG-LAST 1⅛" THREADED.
5 – 1" O.D. ϕ BAR – S.S. – SHAPE SHOWN.
6 – SEAT BRACKETS – 2 PER SEAT S.S.
7 – KEEPER – SEE DETAIL.

Figure 10. Folding Shower Seats for Paraplegic Showers.

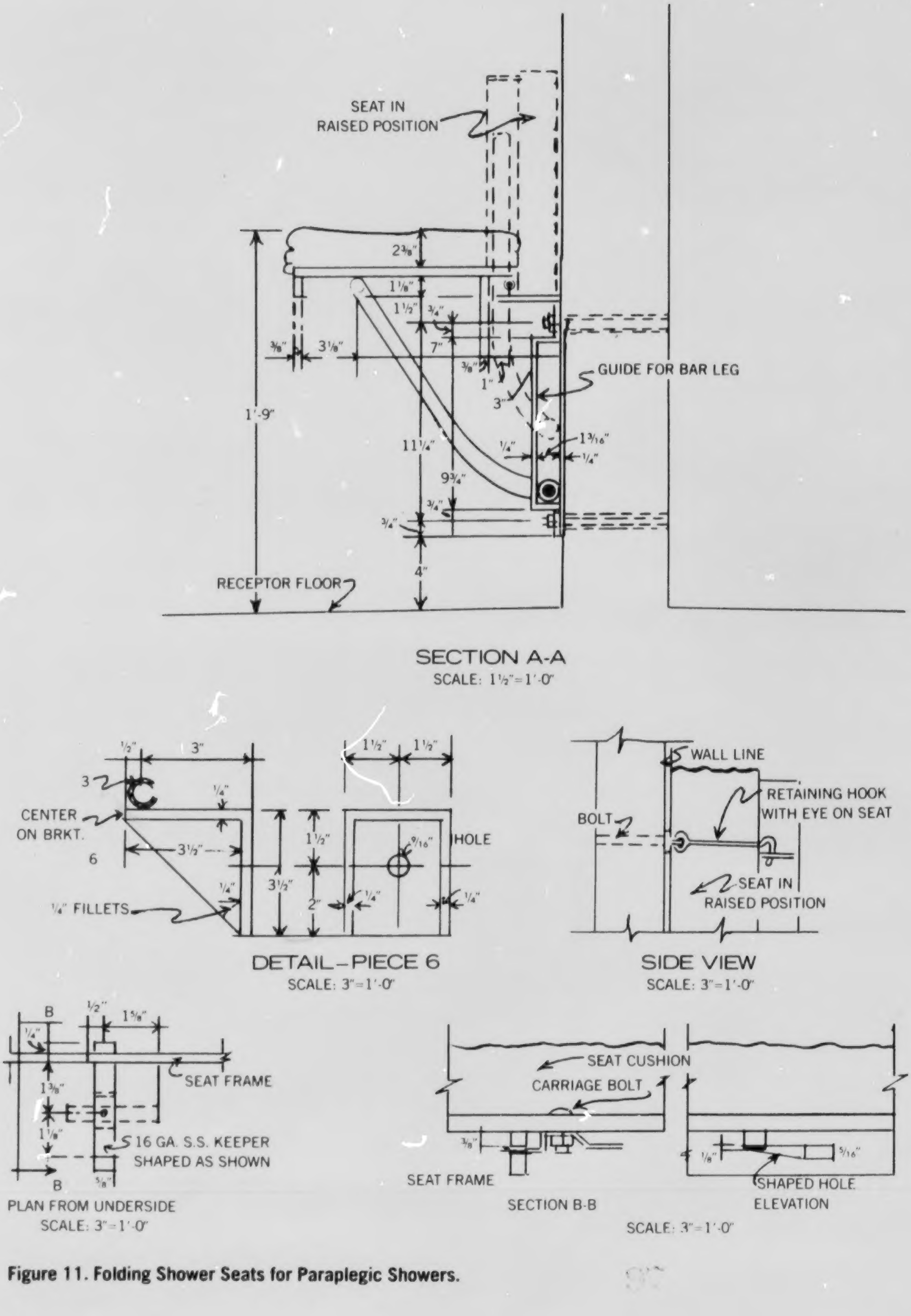
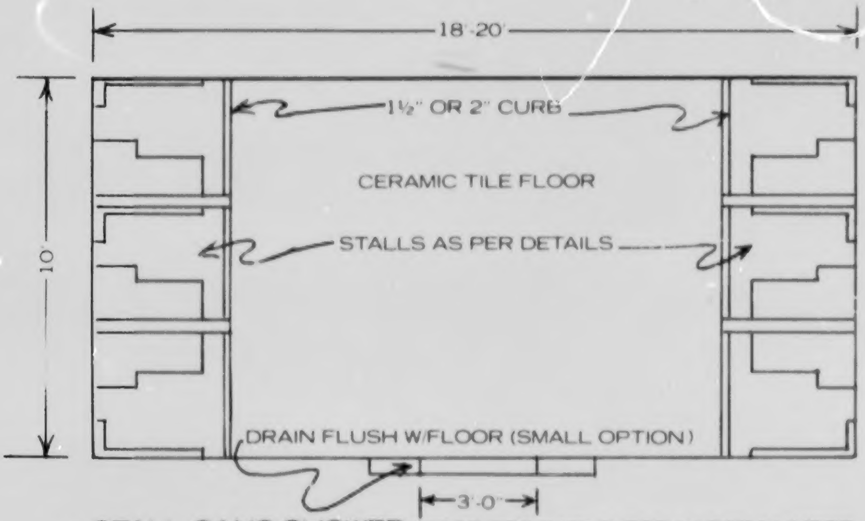
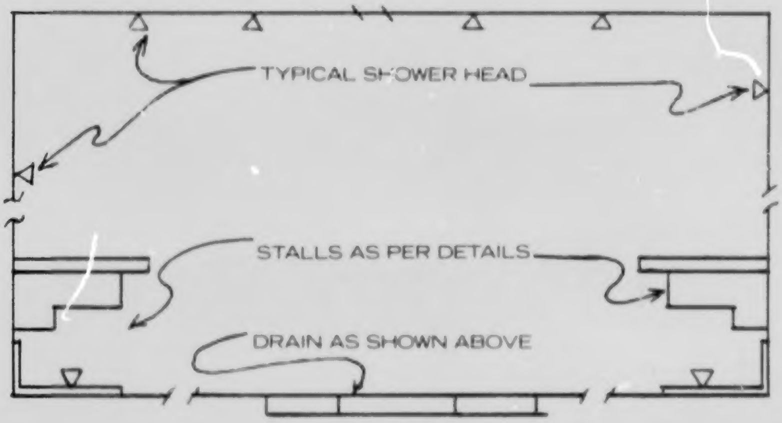

SEAT IN
RAISED POSITION
2⅜"
1⅛"
1½"
¾"
7"
⅜"
3⅛"
⅜"
1"
3"
GUIDE FOR BAR LEG
1'-9"
11¼"
¼"
1³⁄₁₆"
¼"
9¾"
¾"
¾"
4"
RECEPTOR FLOOR
SECTION A-A
SCALE: 1½"=1'-0"
½"
3"
3
¼"
CENTER
ON BRKT.
6
3½"
1½"
3½"
2"
¼"
¼" FILLETS
1½"
1½"
⁹⁄₁₆"
HOLE
¼"
¼"
DETAIL–PIECE 6
SCALE: 3"=1'-0"
WALL LINE
RETAINING HOOK
WITH EYE ON SEAT
BOLT
SEAT IN
RAISED POSITION
SIDE VIEW
SCALE: 3"=1'-0"
B
½"
1⅝"
½"
SEAT FRAME
1⅜"
1⅛"
16 GA. S.S. KEEPER
SHAPED AS SHOWN
B
⅝"
PLAN FROM UNDERSIDE
SCALE: 3"=1'-0"
SEAT CUSHION
CARRIAGE BOLT
⅜"
SEAT FRAME
SECTION B-B
⅛"
⁵⁄₁₆"
SHAPED HOLE
ELEVATION
SCALE: 3"=1'-0"

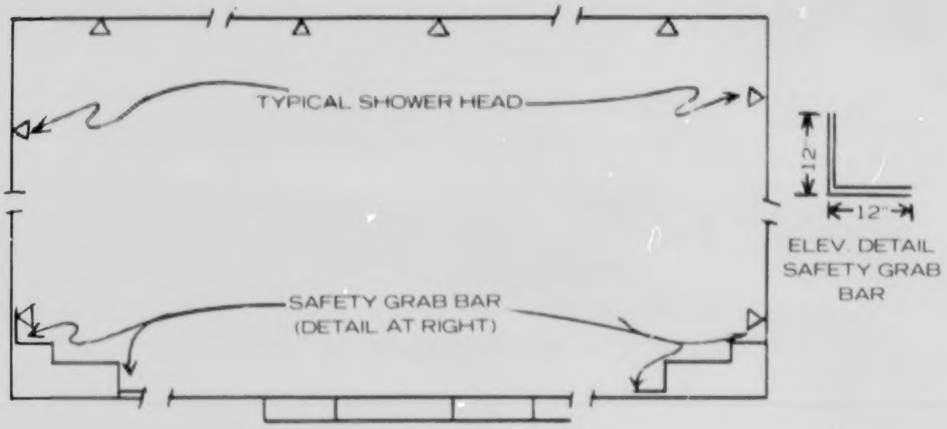
Figure 11. Folding Shower Seats for Paraplegic Showers.


18'-20'
10'
1½" OR 2" CURB
CERAMIC TILE FLOOR
STALLS AS PER DETAILS
DRAIN FLUSH W/FLOOR (SMALL OPTION)
3'-0"

STALL-GANG SHOWER (MOST DESIRABLE FOR LARGE NUMBER OF DISABLED OR AGED)


TYPICAL SHOWER HEAD
STALLS AS PER DETAILS
DRAIN AS SHOWN ABOVE

STALL SHOWER AS PART OF GANG SHOWER
(DESIRABLE FOR MULTI-USE; LIMITED NO. OF AGED & DISABLED)


TYPICAL SHOWER HEAD
SAFETY GRAB BAR
(DETAIL AT RIGHT)
12"
12"
ELEV. DETAIL
SAFETY GRAB
BAR

SEAT IN GANG SHOWER (LEAST DESIRABLE)

Figure 12. Gang Showers

LIGHTING

Lighting requirements for facilities used for athletics, physical education, and recreation involve many considerations. The Illuminating Engineering Society has studied the lighting needs for most of these facilities and has prepared a handbook and various recommended practices as guides for these lighting designs [see references at the end of this chapter]. The following information covers the basic requirements for these lighting systems.

DEFINITION OF TERMS

The following terms are used to describe the various aspects of a lighting system:

adaptation: The process by which the retina becomes accustomed to more or less light than it was exposed to during an immediately preceding period. It results in a change in the sensitivity of the eye to light.

Note: Adaptation is also used to refer to the final state of the process, as reaching a condition of dark adaptation or light adaptation.

ballast: a device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current, and wave form) for starting and operating.

Note: Common electric discharge lamps include fluorescent, mercury, metal halide, and sodium types.

coefficient of utilization: the ratio of the luminous flux (lumens) from a luminaire received on the work-plane to the lumens emitted by the luminaire's lamps alone.

diffuser: a device to redirect or scatter the light from a source, primarily by the process of diffuse transmission.

footcandle: the unit of illumination when the foot is taken as the unit of length. It is the illumination on a surface one square foot in area on which there is a uniformly distributed flux of one lumen, or the illumination produced on a surface all points of which are at a distance of one foot from a directionally uniform point source of one candela.

footlambert: a unit of luminance (photometric brightness) equal to $1/\pi$ candela per square foot, or to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square foot, or to the average luminance of any surface emitting or reflecting light at that rate.

glare: the sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility.

illumination: the density of the luminous flux incident on a surface; it is the quotient of the luminous flex divided by the area of the surface when the latter is uniformly illuminated.

Note: The term illumination also is commonly used in a qualitative or general sense to designate the act of illuminating or the state of being illuminated. Usually the context will indicate which meaning is intended, but occasionally it is desirable to use the expression "level of illumination" to indicate that the quantitative meaning is intended.

light (for the purposes of illuminating engineering): visually evaluated radiant energy.

Note: Light is psychophysical, neither purely physical nor purely psychological. Light is not synonymous with radiant energy, however restricted, nor is it merely sensation. In a general, nonspecialized sense, light is the aspect of radiant energy of which a lumen observer is aware through the stimulation of the retina.

light loss factor: a factor used in calculating the level of illumination after a given period of time and under given conditions. It takes into account temperature and voltage variations, dirt accumulation on luminaire and room surfaces, lamp depreciation, maintenance procedures, and atmospheric conditions.

luminaire: a complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

visibility: the quality of state of being perceivable by the eye. In many outdoor applications, visibility is defined in terms of the distance at which an object can be just perceived by the eye. In indoor applications it usually is defined in terms of the contrast or size of a standard test object, observed under standardized viewing conditions, having the same threshold as the given object.

visual perception: the interpretation of impressions transmitted from the retina to the brain in terms of information about a physical world displayed before the eye.

Note: Visual perception involves any one or more of the following: recognition of the presence of something (object, aperture, or medium); identifying it; locating it in space; noting its relation to other things; identifying its movement, color, brightness, or form.

visual task: conventionally designates those details and objects that must be seen for the performance of a given activity and includes the immediate background of the details or objects.

work-plane: the plane at which work usually is done and at which the illumination is specified and measured. Unless otherwise indicated, the work-plane is assumed to be a horizontal plane 30 inches above the floor.

OBJECTIVES

The purpose of lighting is to enable people to see their environment and to move about and work within it; however, the objectives are actually much broader in scope. Lighting is also a dominant factor in providing a desirable environment. It affects the usefulness and enjoyment of any space, and it is often an indispensable part of an architectural concept.

Light provides the essential ingredient to see the structure, form, color, and brightness patterns in any space. Light thus becomes an element of architectural design. The most important function of light, however, is to accommodate the performance of tasks. In order to understand the lighting requirements in any facility, it is therefore important to understand first the visual task to be performed in the facility.

The visibility of each task is determined by its size, its contrast of detail with the background, its luminance, and length of time for viewing. The factors of size and contrast (under a given lighting system) are inherent in the seeing task, and comparatively little can be done to change them. What can be changed are the luminance of the task (which depends upon the reflectance of the surface and the level of illumination falling upon it) and the type of lighting. It follows, therefore, that the quality and control of light are more important than the quantity of light. Through research and field experience, principles of luminance distribution have been established that can provide an efficient, comfortable, and pleasing environment. The concept envisions the task as the focal point of design with the appropriate surroundings contributing to the efficiency of seeing the task, the elimination of hindering glare, and the positive feeling of pleasantness throughout the space.

As the eye scans a task an adaptation level is established consisting primarily of the task luminance. As the eyes leave the task to look at an area of different luminance, there is a sudden loss of sensitivity to see the contrast of the detail in the new area until the eyes can readapt an appropriate length of time. In order to see immediately anywhere in the visual environment, the luminance of appreciable areas should be kept within a 3 to 1 ratio. The maximum versus minimum luminance *of appreciable areas* throughout a space should be held within a 10 to 1 ratio.

QUANTITY OF ILLUMINATION

A good lighting installation can result only from careful blending of the proper quantity of light, which is relatively easy to provide, with a good quality of light. The poorer the quality of the lighting installation, the greater the quantity of light required to obtain a given degree of visual performance. Studies by the lighting industry have resulted in the recommendations in Table 1 for the quantity of illumination needed for specific areas.

While for convenience of use this table sometimes lists locations rather than tasks, the recommended footcandle values have been arrived at for specific visual tasks. The tasks selected for this purpose have been the more difficult ones commonly occurring in the various areas. Depending upon the area and the task, the illumination levels can be provided throughout the total space or at individual work stations. Where the tasks occur at individual work stations the illumination levels may be provided by supplementary luminaires used in combination with general lighting.

DESIGN FACTORS

After determining lighting needs and quality factors, we are ready to proceed with a system design. The principal consideration is choice of equipment and method of installation. Involved in the choice of light source, luminaires, and auxiliary equipment along with their ability to maintain their performance are several key factors.

There are many types of light sources. The essential characteristics of these sources are illustrated in Table 2. The best results are not necessarily obtained from the source with the highest rating for these combined characteristics. To illustrate this point, consider the life category. The mercury lamp has a "high" life rating, since it normally provides 21,000 hours of operation. If an outdoor facility will have only summer usage, the annual usage might be 400 hours. It would be inappropriate to assume that 60 years of usage is plausible and therefore of any comparative value. For an indoor installation with 6,000 hours usage per year, the lamp life, however, does have significance.

Each of the comparative characteristics should be judged as it relates to the system needs. The lumen output per lamp is a rating of light energy per luminaire and therefore relates to the numbers of units to be installed. Some fluorescent systems, especially those used indoors, will have several lamps per luminaire to compensate for their low output. This factor must also be associated with efficacy, which is a rating of light output versus power input. The energy crisis has made efficacy of great concern as attempts are made to gain the greatest performance from power resources. These factors will later be related to the luminaire, since there is a concern not only for the light source to produce energy but the luminaire to deliver it where it is needed.

As previously illustrated, the life expectancy must be related to system usage. In general the incandescent lamp with a low rating normally has a life of 1,000 to 2,000 hours, and the mercury lamp and its high rating relate to a 21,000-hour life. In some installations, a 2,000-hour life is excessive, and incandescent lamps may be operated at higher voltage to increase performance by 25 percent with a life reduction of 600 to 800 hours.

Color is a subjective characteristic. If designers are attempting to create a pleasant atmosphere for players and spectators, then the color is important. In an interior, the color of the ceiling, walls, and floor can compensate for the deficiencies of a lamp. In fact, color factors are more important in indoor than outdoor facilities, because they create contrasts between outdoors, lounge, locker rooms, playing surfaces, and other areas. In the outdoors at night, unless there are large adjacent areas with different sources, the only difference is that of the lighted area and the unlighted surroundings. The eye and brain will adjust to these conditions, and objects will look natural even though their color is much different from what it is in daylight.

One characteristic of light sources important to sport and recreational facilities, not included in Figure 2, is the strobo-

TABLE 1
RECOMMENDED ILLUMINATION FOR SPECIFIC AREAS

Sport and Recreational Areas	Footcandles on Tasks*
Archery (indoor)	
Target, tournament	50[f]
Target, recreational	30[f]
Shooting line, tournament	20
Shooting line, recreational	10
Archery (outdoor)	
Target, tournament	10[f]
Target, recreational	5[f]
Shooting line, tournament	10
Shooting line, recreational	5
Badminton	
Tournament	30
Club	20
Recreational	10
Baseball	
Major league	
Infield	150
Outfield	100
AA and AAA league	
Infield	70
Outfield	50
A and B league	
Infield	50
Outfield	30
C and D league	
Infield	30
Outfield	20
Semipro and municipal league	
Infield	20
Outfield	15
Recreational	
Infield	15
Outfield	10
Junior league (Class I and Class II)	
Infield	30
Outfield	20
On seats during game	2
On seats before and after game	5
Basketball	
College and professional	50
College intramural and high school	30
Recreational (outdoor)	10
Bathing beaches	
On land	1
150 feet from shore	3[f]
Billiards (on table)	
Tournament	50
Recreational	30
Bowling[s]	
Tournament	
Approaches	10
Lanes	20
Pins	50[f]
Recreational	
Approaches	10
Lanes	10
Pins	30[f]
Bowling on the green	
Tournament	10
Recreational	5
Boxing or wrestling (ring)	
Championship	500
Professional	200
Amateur	100
Seats during bout	2
Seats before and after bout	5
Casting—bait, dry-fly, wet-fly	
Pier or dock	10
Target (at 80 feet for bait-casting and 50 feet for wet or dry fly-casting)	5[f]
Combination (outdoor)	
Basketball/football	
Infield	20
Outfield and football	15
Industrial softball/football	
Infield	20
Outfield	15
Industrial softball/6-man football	
Infield	20
Outfield	15
Croquet or Roque	
Tournament	10
Recreational	5
Curling	
Tournament	
Tees	50
Rink	30
Recreational	
Tees	20
Rink	10
Fencing	
Exhibitions	50
Recreational	30
Football	
Distance from nearest sideline to the farthest row of spectators	
Class I—over 100 feet	100
Class II—50 feet to 100 feet	50
Class III—30 feet to 50 feet	30
Class IV—under 30 feet	20
Class V—no fixed seating facilities	10

It is generally conceded that the distance between the spectators and the play is the first consideration in determining the class and lighting requirements. However, the potential seating capacity of the stands should also be considered and the following ratio is suggested: Class I for over 30,000 spectators; Class II for 10,000 to 30,000; Class III for 5,000 to 10,000; and Class IV for under 500 spectators.

Sport and Recreational Areas	Footcandles on Tasks*
Football, Canadian—rugby (see Football)	
Football, six-man	
High school or college	20
Jr. high and recreational	10
Golf	
Tee	5
Fairway	1,3[f]
Green	5
Driving range	
At 200 yards	5[f]
Over the area	10
Miniature	10
Practice putting green	10
Gymnasiums (refer to individual sports listed)	
Exhibitions, matches	50
General exercising and recreation	30
Assemblies	10
Dances	5
Lockers and shower rooms	20
Handball	
Tournament	50
Club	
Indoor—four-wall or squash	30
Outdoor—two-court	20
Recreational	
Indoor—four-wall or squash	20
Outdoor—two-court	10
Hockey, field	20
Hockey, ice (indoor)	
College or professional	100
Amateur	50
Recreational	20

Sport and Recreational Areas	**Footcandles on Tasks***
Hockey, ice (outdoor)	
College or professional	50
Amateur	20
Recreational	10
Horseshoes	
Tournament	10
Recreational	5
Horse shows	20
Jai-alai	
Professional	100
Amateur	70
Lacrosse	20
Playgrounds	5
Quoits	5
Racing (outdoor)	
Auto	20
Bicycle	
Tournament	30
Competitive	20
Recreational	10
Dog	30
Dragstrip	
Staging area	10
Acceleration, 1320 feet	20
Deceleration, first 600 feet	15
Deceleration, second 600 feet	10
Shutdown, 820 feet	5
Horse	20
Motor (midget or motorcycle)	20
Rifle (50 yards—outdoor)	
On targets	50^f
Firing point	10
Range	5
Rifle and pistol range (indoor)	
On targets	100^f
Firing point	20
Range	5
Rodeo	
Arena	
Professional	50
Amateur	30
Recreational	10
Pens and chutes	5
Roque (see Croquet)	
Shuffleboard (indoor)	
Tournament	30
Recreational	20
Shuffleboard (outdoor)	
Tournament	10
Recreational	5
Skating	
Roller rink	10
Ice rink, indoor	10
Ice rink, outdoor	5
Lagoon, pond, or flooded area	1
Skeet	
Targets (at 60 feet)	30^f
Firing points	5
Skeet and trap (combination)	
Targets (at 100 feet for trap, 60 feet for skeet)	30^f
Firing points	5
Ski slope	1
Soccer (see Football)	
Softball	
Professional and championship	
Infield	50
Outfield	30
Semiprofessional	
Infield	30
Outfield	20

Sport and Recreational Areas	**Footcandles on Tasks***
Industrial league	
Infield	20
Outfield	15
Recreational (6-pole)	
Infield	10
Outfield	7
Slow pitch, tournament, see industrial league	
Slow pitch, recreational (6-pole)—see recreational (6-pole)	
Squash (see Handball)	
Swimming (indoor)	
Exhibitions	50
Recreational	30
Underwater—100 lamp lumens per square foot of surface area	
Swimming (outdoor)	
Exhibitions	20
Recreational	10
Swimming (outdoor) (continued)	
Underwater—60 lamp lumens per square foot of surface area	
Tennis, lawn (indoor)	
Tournament	50
Club	30
Recreational	20
Tennis, lawn (outdoor)	
Tournament	30
Club	20
Recreational	10
Tennis, table	
Tournament	50
Club	30
Recreational	20
Trap	
Targets (at 100 feet)	30^f
Firing points	5
Volleyball	
Tournament	20
Recreational	10

General Areas	**Footcandles on Tasks***
Auditoriums	
Assembly only	15
Exhibitions	30
Social activities	5
Club and lodge rooms	
Lounge and reading rooms	30
Dance halls	5
Food service facilities	
Dining areas	
Cashier	50
Intimate	
Light environment	10
Subdued environment	3
For cleaning	20
Leisure	
Light environment	30
Subdued environment	15
Quick service	
Bright surroundings^n	100
Normal surroundings^n	50
Food displays—twice the general levels but not under	50
Kitchen, commercial	
Inspection, checking, preparation, and pricing	70
Entrance foyer	30
Library	
Reading areas	
Reading printed material	30
Study and note taking	70
Conference areas	30
Seminar rooms	70
Book stacks (30 inches above floor)	
Active stacks	30^f
Inactive stacks	5^f

General Areas	**Footcandles on Tasks**[*]
Book repair and binding	70
Cataloging	70[r]
Card files	100[†]
Carrels, individual study areas	70[†]
Circulation desks	70[†]
Rare book rooms—archives	
Storage areas	30
Reading areas	100[†]
Map, picture, and print rooms	
Storage areas	30
Use areas	100[†]
Audiovisual areas	
Preparation rooms	70
Viewing rooms (variable)	70
Television receiving room (shield viewing screen)	70
Audio listening areas	
General	30
For note taking	70[†]
Record inspection table	100[a]
Library (continued)	
Microform areas	
Files	70[†]
Viewing areas	30
Locker rooms	20
Offices	
Accounting offices	
Auditing, tabulating, bookkeeping, business machine operation, computer operation	150[†]
General Offices	
Reading poor reproduction, business machine operation, computer operation	150[†]
Reading handwriting in hard pencil or on poor paper, reading fair reproductions, active filing, mail sorting	100[†]
Reading handwriting in ink or medium pencil on good quality paper, intermittent filing	70[†]
Private offices	
Reading poor reproductions, business machine operation	150[†]
Reading handwriting in hard pencil or on poor paper, reading fair reproductions	100[†]
Reading handwriting in ink or medium pencil on good quality paper	70[†]
Reading high-contrast or well-printed materials	30[†]
Conferring and interviewing	30
Conference rooms	
Critical seeing tasks	100[†]
Conferring	30
Note-taking during projection (variable)	30[†]
Corridors	20[k]
Parking Areas	
Indoor Garage	
Entrance	50
Traffic lanes	10
Storage	5
Exterior lots	0.5
Schools	
Tasks	
Reading printed material	30[†]
Reading pencil writing	70[†]
Spirit duplicated material	
Good	30[†]
Poor	100[†]
Drafting[r], bench work	100[a]
Lip reading, chalkboards[r], sewing	150[a]
Classrooms	
Art rooms	70
Drafting rooms	100[a]†
Home economics rooms	
Sewing	150[a]
Cooking	50
Ironing	50
Sink activities	70
Note-taking areas	70[†]
Laboratories	100
Lecture rooms	
Audience area	70[†]
Demonstration area	150[a]
Music rooms	
Simple scores	30[†]
Advanced scores	70[q]†
Shops	100[a]
Sight-saving rooms	150[a]†
Study halls	70[†]
Typing	70[†]
Corridors and stairways	20
Dormitories	
General	10
Reading books, magazines, newspapers	30[†]
Study desk	70[†]
Service space (see also storage rooms)	
Stairways, corridors	20
Elevators, freight and passenger	20
Toilets and washrooms	30
Storage rooms or warehouses	
Inactive	5
Active	
Rough bulky	10
Medium	20
Fine	50
Toilets and washrooms	30
Walkways	0.5

FOOTNOTES

[*] Minimum on the task at any time for young adults with normal and better than 20/20 vision

[†] Equivalent sphere illumination

[a] Obtained with a combination of general lighting plus specialized supplementary lighting. Care should be taken to keep within the recommended luminance ratios. These seeing tasks generally involve the discrimination of fine detail for long periods of time and under conditions of poor contrast. The design and installation of the combination system must not only provide a sufficient amount of light, but also the proper direction of light, diffusion, color, and eye protection. As far as possible it should eliminate direct and reflected glare as well as objectionable shadows

[k] Or not less than 1/5 the level in adjacent levels

[n] Including street and nearby establishments

[q] Localized general lighting

[r] Vertical

[s] Levels shown are based on visual considerations. Otherwise for public attraction and increased business considerations, practice is as follows

Class	Approaches	Lanes	Pins
Tournament	70 fc	100 fc	200 fc vertical
Recreational	50 fc	70 fc	150 fc vertical

scopic effect. All sources in the list except incandescent and tungsten halogen types exhibit some degree of rapid output variation, or stroboscopic effect, which can make rapidly moving objects appear to jump from place to place rather than flow along a path. If there is no limitation to the available power source, then operating the system from a three-phase supply can eliminate the problem. Several points within the space must then be illuminated by overlapping beams from luminaires operated from more than one phase of the power supply.

The combination of light source and the optical control of the luminaire govern the light distribution. General lighting systems should provide a high degree of uniformity, and glare control is always an important consideration. These factors relate to the beam control available from the luminaires and the necessity for louvers or shields to control glare. The beam control relates to the proximity of the luminaires to the lighting task, since wide beams are generally used when in close proximity and narrow beams are needed when distances are great.

Table 2. Comparative Characteristics of Light Sources for General Lighting Purposes.

	Lumen Output Per Lamp	Efficacy	Life Expectancy	Color Acceptability	Degree of Light Control	Maintenance of Lumen Output
INCANDESCENT	FAIR	LOW	LOW	HIGH	HIGH	GOOD
TUNGSTEN HALOGEN	FAIR	LOW	LOW	HIGH	HIGH	HIGH
MERCURY	GOOD	FAIR	HIGH	LOW	GOOD	GOOD
PHOSPHOR MERCURY	GOOD	FAIR	HIGH	FAIR TO GOOD	FAIR	FAIR
METAL HALIDE	HIGH	GOOD	FAIR	GOOD TO HIGH	GOOD	FAIR
HIGH-PRESSURE SODIUM	HIGH	HIGH	FAIR	FAIR	GOOD	GOOD
40-WATT FLUORESCENT	LOW	GOOD	GOOD	GOOD TO HIGH	LOW	GOOD
HIGH-OUTPUT FLUORESCENT	FAIR	GOOD	GOOD	GOOD TO HIGH	LOW	GOOD
1500-MA FLUORESCENT	GOOD	GOOD	FAIR	GOOD TO HIGH	LOW	FAIR

There are four ratings for each characteristic—high, good, fair, and low.

As beam control becomes important, the amount of light delivered by the luminaire becomes critical. Luminaires are available for all light sources to provide efficient wide beam distribution. Louvers or shields to achieve glare control generally reduce efficiency, and narrow-beam luminaires are generally less efficient than wide-beam luminaires. System performance must therefore be based on the light delivered to the task and not on how much light the source produces.

The maintenance factors for the lighting system involve loss of light output from the lamp as a function of life; dirt accumulation on the lamp, reflector, and lens; and component failure. The lamp loss can range from a small amount to more than 30 percent, depending upon the atmosphere and whatever cleaning cycle is established; the dirt accumulation can also range from a small amount to more than 30 percent. Most components should have from a 10- to 20-year minimum life, but some failure of ballasts, sockets, and other components should be expected. Thus, the average output of a system that is not maintained could range from 50 to 75 percent of initial output. Based on the experience in a given area with dirt accumulation and the type of lamp and fixture installed, a definite maintenance program should be established. The maintenance schedule can be correlated with lamp replacement to limit the high cost of individual replacements of burned-out lamps in inaccessible floodlight locations. Whatever maintenance program is established, it should be included in considerations of the total cost for the system. It will also be a factor in the calculation of system performance, which should be based on the average performance of the system at any time in its life.

The design of the electrical system must include factors other than a three-phase supply to eliminate potential stroboscopic effect. Of equal concern is the voltage provided to the lamp or ballast. Most systems place the source of power, distribution panels, and luminaires at locations of some distance from one another. Such placement results in a voltage loss, which reduces the light output of the lamp. It is normal for this variation to reduce the voltage at remote luminaires by 5 percent, which means about a 10 percent reduction in light output. Some types of ballasts can reduce this loss, while some systems might have a greater voltage drop and resultant loss. In order to avoid variations in output of 10 percent to as much as 50 percent, it is essential to include considerations of the lamp, luminaires, maintenance, and electrical systems in the total system design.

Optimum Use of Energy

The waste of energy is an added design concern for all facilities, requiring the following considerations:

Design lighting for expected activity. Most sport and recreational facilities require general lighting throughout the space to accommodate a specific activity. For multipurpose areas, the lighting must meet the most severe requirements of the intended use. A lighting system can provide multiplicity of levels, however, through switching or dimming systems to accommodate less severe requirements for other usage. Where tasks are localized, such as at counters or desks, the lighting system can be designed to provide the needs at that location. The general lighting can then be reduced; however, the luminance-ratio limitations should be observed.

Design for greatest effectiveness. Lighting systems that require louvers, baffles, and shields to limit glare are reduced in their effectiveness. Judgment of system quality can be more important in comparing the performance of two systems than the light level they deliver. System comparison must therefore involve more than a consideration of the wattage required to produce a given level of illumination.

Use efficient light sources. Efficacy—the efficiency rating of light source—is illustrated in Table 2.

Use more efficient luminaires. The efficiency of a luminaire tempered by its method of application determines its acceptability for a given system design. When the distance from luminaire to task is great, a wide-beam luminaire may be more efficient than a narrow-beam luminaire but deliver less light to the task.

Select surface finishes with care. Dark finishes absorb light, whereas light finishes can cause glare. The selection of surface finishes is therefore a compromise of high reflectance to reduce the lighting requirement and low reflectance to achieve maximum contrast. In general, this means that ceilings should have high reflectance, walls should have a middle range of reflectance, and working surfaces and floors should have a low reflectance to provide maximum background contrast for the task to be performed.

Provide flexibility in the control of lighting. In areas having multiple usage, the lighting system should be controlled to meet only the needs of each use. Designers may have to provide different levels of illumination to meet the needs both of recreational usage and of tournament play in a sport facility or to allow control for each court in a multiple tennis court facility.

Utilize daylight where practical. Daylight can supplement and, in some cases, eliminate the need for artificial lighting in interiors used in the daytime. However, it requires the utmost care to achieve acceptable results in such designs.

Provide for system maintenance. Selecting luminaires with good cleaning capability and lamps with easy maintenance and establishing a systematic maintenance program can result in a minimum of performance reductions during the system's life. The result is reduced power requirement to achieve a minimum given level of illumination.

Design Procedure

Design of a lighting system can best be accomplished by the following steps:

1. Establish design objectives.
    a. Seeing task
    b. Quality requirements
    c. Quantity requirements
2. Determine environmental specifications.
    a. Area atmosphere
    b. Area description
3. Select luminaire.
4. Consider unrecoverable light loss factors.
    a. Luminaire ambient temperature
    b. Voltage to luminaire
    c. Ballast factor
    d. Luminaire surface depreciation
5. Consider recoverable light loss factors.
    a. Room surface dirt depreciation
    b. Burn-outs unreplaced
    c. Lamp lumen depreciation
    d. Luminaire dirt depreciation

(If losses are too great in 4 or 5, reselect luminaire with smaller losses.)

6. Make calculations.
    a. Total light loss factor
    b. Average illumination
7. Lay out system.
8. Review compliance with objectives (if neither the design objectives nor the budget requirements have been met, the design process should begin again).

This flow chart gives the basic considerations involved in arriving at a suitable solution to the lighting problem.

Economics is a major factor in determining the acceptability of a lighting system. Too often only the initial system cost is considered. Recently life-cycle costing has become the important consideration. This includes not only the initial installed cost but also considers maintenance and other annual costs as well as the depreciation and replacement costs.

Beyond system economics other important items to consider in evaluating lighting systems are as follows:

1. Visual comfort
2. Compatibility with architectural design
3. Flexibility of arrangement
4. Controllability
5. Compatibility with environmental elements
6. Performance
7. Aesthetics.

Design procedure and the basis for system evaluation require some degree of technical competence. It is therefore very important to obtain competent technical assistance, usually from private consulting firms, local utility companies, and manufacturers of lighting equipment. Their assistance may be invaluable in preventing costly mistakes.

Lighting system design must also meet the needs of local, state, and federal codes. These could involve building codes, safety codes, and electrical codes. Competent design assistance will also ensure meeting these requirements.

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Chapter 8

TRENDS in FACILITY CONCEPTS

Many factors influence the type of facilities developed for physical education, recreation, and athletics. Increasing demands of today's society, changing emphases and trends, and ever-expanding programs have recently caused professional educators to become concerned about their ability to obtain adequate and functional facilities.

Administrators in the fields of physical education, recreation, and athletics are becoming better professionally trained and, therefore, more sophisticated in operating their programs. They are likewise more skilled at planning new facilities and modifying existing ones to enable their departments to accomplish their goals more fully.

In an era when the expenditure of dollars for a specific and limited operation is generally looked upon as frivolous, administrators in physical education, recreation, and athletics are challenged to make the most of expenditures in all areas of their budget—including facility development. Increasing joint occupancy by school systems and recreation departments, colleges and community groups, and—in many instances—public and private enterprise have led to a stretching of what the dollar can buy in initial facility development as well as in maintenance and operation.

A comparatively new organization, the National Association of Collegiate Directors of Athletics (NACDA), has taken a great interest in upgrading organizational and administrative abilities and providing additional training for its member athletic directors in an effort to keep them abreast of ever-changing trends and emphases. Facility construction has been one of the areas in which NACDA's education committee has been actively involved. This committee has organized at least five study-clinics devoted specifically to aspects of facility planning and construction. The emphasis of these study-clinics has been on innovative concepts in facility design, including artificial turf and other outdoor and indoor surfaces, air-supported structures, plastic ice, new methods of freezing ice, membrane structures, foam structures, modular buildings, turn-key operations, and joint occupancy. Other topics include environmental control, seating, locker rooms, laundry facilities, equipment operation, swimming pool design, tennis court construction, and some general planning considerations.

Today, the administrator must sell the concept of the discipline's contribution to the health and well-being of the total person and be innovative in his approach to obtaining the maximum facility for year-round use. He must change the present attitude, held by so many, that a person's physically active period begins on Memorial Day and ends on Labor Day.

Richard Theibert, a facility consultant with the Educational Facilities Laboratory (EFL), believes that technology is years ahead of concepts and that innovative thinking would help both combat the dollar shortage and provide better services for physical education, recreation, and athletics. The idea of a physical education and recreational facility having one surface with multiple uses might be one answer to providing flexible facilities for increased use. Harold Gores, president of EFL, maintains that a program that is dependent on the weather is "primitive," and that "America's health is too important to be dependent on the weather."

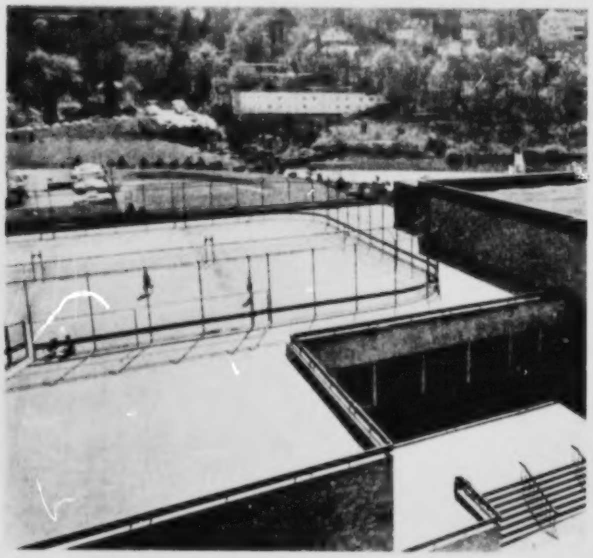
Boards of education, college trustees, and city recreation commission members are beginning to recognize the importance of involving program personnel early in the planning process. The thoughtless imitation of facilities of other institutions and organizations may only lead to reproductions of existing inadequacies and not reflect the unique program of the copying organization.

Two common characteristics of any new facility should be its flexibility and its expandibility to accommodate changing curriculums and activities. The need for careful, planned, and systematic study in the selection, acquisition, development, and utilization of school property is increasing. The site should be selected and acquired on the basis of the particular functions to be fulfilled. Thinking of the outdoor field area and the adjacent building as one facility is critical to the most effective and efficient development of educational sites. According to Theibert, "The astute physical educator is one who thinks of a building and a field as one."

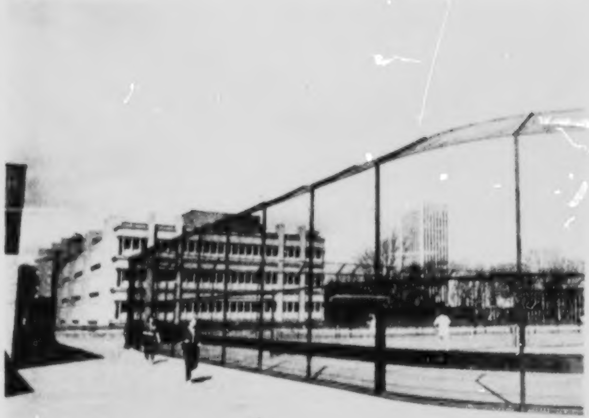
Recently built school facilities have reflected an increasing concern with the environmental effects of physical space on teaching and learning. Buildings must be planned to accommodate the new methods of teaching and the greater use of audiovisual teaching aids and television. Although standardization of certain plumbing and light fixtures may reduce maintenance costs, standardization should not be overemphasized at the risk of inflexibility and resistance to change.

A facility should not be predicated upon programs developed prior to the existence of adequate facilities. The program and facilities should provide for a wide diversity of activities that take into consideration increasing leisure time and other important trends in the fields of physical education, recreation, and athletics.

According to the report of the Outdoor Recreation Resources Review Commission, the outdoor recreational interests of Americans have increased greatly in recent years. The report shows tremendous increases in the number of people who boat, hunt, canoe, swim, camp, hike, fish, ski, and engage in other outdoor pursuits. In



Portland State College, Portland, Oregon.



Portland State College, Portland, Oregon.

addition, water skiing, scuba diving, rock climbing, back packing, and bicycling are more popular today than they were a few years ago. But the traditional activities of golf, archery, tennis, bowling, gymnastics, and others should not be neglected in planning, as these leisure activities are continuing to grow in popularity and are indeed worthy of inclusion.

The school-community concept involving coordinated programs, and sometimes dual use of facilities, along with the increasing institutional or departmental involvement socially, politically, and culturally, need to be considered.

Planning should be for a multipurpose facility with areas for numerous types of activities, rather than for a spectator sport palace that can be used for only one sport. More facilities should be designed to bring the out-of-doors indoors. Examples are the numerous indoor tennis courts, tracks, and turfed areas currently being developed. The facility that can serve for indoor tennis, basketball, volleyball, badminton, track, archery, golf driving, and numerous other activities has far greater use for the total community.

With today's technology, contemplating maximum multi-use functional spaces at an economical cost is possible. It is feasible for educational planners to abandon traditional planning procedures and to think in terms of developing rooftop fields and/or court areas, (e.g., tennis) above such other structures as parking lots, gymnasiums, shipping piers, and the like. Examples are such buildings as those at Portland State College in Oregon (see Figure 1) and Knoxville College in Tennessee (see Figure 2).

It is also practical to defray expenses by having commercial enterprises share the cost of construction and the joint use of the building, as is being done in New York City, or by entering into the joint use of a site through a lease arrangement to a commercial enterprise, e.g., an office complex as at the Friends Select School in downtown Philadelphia (see Figure 3).

In some places the use of artificial surfacing is replacing grass and wood. New methods of freezing ice, coupled with encapsulated buildings in the form of air-pressure-supported structures, are exemplified in structures at Harvard and Columbia Universities (see Figure 4), at the Wall Street Racquet Club in New York City (see Figure 5), or at Brooklyn Polytechnic Institute in New York City (see Figure 6). Cable-supported air structures are used in the American Pavilion in Osaka, Japan (see Figure 7), and at Milligan's College in Johnson City, Tenn., where the largest permanent air structure in the United States (enclosing 15,000 square feet) is being constructed. This structure involves an earth berm for the exterior wall, which also serves to anchor the cables extending across the top of the membrane to stabilize it during high winds (see Figure 8). A cable-supported foam structure has been built at Graceland College, Lamoni, Iowa (see Figure 9).

An increasing need has developed in recent years among educational institutions, both public and private, for inexpensive wide-span structures to enclose large areas for recreational and athletic activities. One example is at Idaho State University in Pocatello, where a $2.8-million domed facility houses a football stadium as well as other athletic and physical education facilities (see Figure 10). The Idaho State University structure is the first covered collegiate stadium in the United States. The synthetic turf used in this stadium permits the carpeted football field to serve as a surface for all types of other activities (see Figure 11).

In Alaska, a 10-acre membrane-covered structure, housing a shopping mall, sport facilities, and parking areas, is planned. Generally, the larger the area covered with this type of structure, the lower the cost per square foot. Some manufacturers of these newer structures and materials now offer package deals, including various types of surfacing, lighting, and other features. Such "turn-key" facilities offer unique advantages in terms of cost saving, but most of those built to date have not provided sufficient space.

Any attempt to decide what facilities and equipment are necessary for a particular program must be done in the institution involved. Decisions should be made in keeping with the overall philosophy of the institution and the specific programs in physical education, recreation, and athletics. A study of the history of the institution, its

American Pavilion, Osaka, Japan.

current program, its facilities, and what it visualizes as its future growth and direction must be considered prior to embarking on a building program.

The institution and the physical education, recreation, and athletic department must analyze their needs and then answer specific questions about the relation of the various programs and areas to each other. This analysis should be specific as to what is being done in each area. The resulting facility will be far more likely to meet specific needs than would one planned without such an analysis.

The concept of the ability to reassign space from one activity to another, possibly by having large areas that can be subdivided and/or changed as needed, might prove quite functional. The concept of providing portable indoor recreational facilities might not be too far-fetched. Consider a mobile structure fitted with locker, shower, and changing facilities and attached by a breezeway to an air-supported structure. This self-contained locker and showering facility, along with the air structure, could be moved from one part of the community to another and from one community to another as the need arises.

In short, the trends in facilities should reflect the trends in programs as well as the development of new technologies that provide new materials and methods of instruction. The ultimate objective is to provide large areas capable of being modified at minimum cost to handle a wide and varied program for both the institution and the community.

Part Three—Sport and Athletic Facilities

Chapter 1

FIELDS and COURTS

BALL FIELDS

The playfield has long been a popular school facility. Throughout the school year and during the summer as well, youngsters have traditionally made the most of the open space provided for them. Steps should be taken in the initial planning of a community school program to make the playfield as accessible and functional as possible.

Three improvements could be made to encourage wider community use of the already popular playground. Paving an outdoor basketball court probably does more to encourage use of the playground than any other single improvement, since a large number of recreational activities are best carried out on a hard surface.

A lighted baseball or softball field is a second improvement that will increase playground usage. Both adults and children can use the field in the evenings for organized or casual recreational activities.

A third improvement found to be valuable is the provision of washroom facilities accessible from the playground as well as from inside the building. This arrangement makes these facilities available when most of the school building is not in use.

Baseball

Baseball is one of the most popular team sports in the United States and has held this distinction for over a century. It currently serves junior, interscholastic, college, and adult groups on a large scale.

A baseball field should be located away from activities for small children. It should not overlap football or track areas. The high school or college field requires approximately three acres. If an outfield fence is used, it is generally placed approximately 325 to 340 feet from home plate down each foul line. The fence in straightaway center field is usually from 385 to 410 feet from home plate. The diamond is 90 feet square.

It is important that there be a large frame backstop with sturdy wire netting 60 feet behind home plate. This backstop ought to be 20 to 25 feet high to help keep the ball in the field of play. Attached to each end of the backstop should be a fence at least four feet high, 60 feet from the nearer foul line, and extending to the outfield fence where it joins it on foul ground 60 feet from the foul line. Where it is necessary to put the backstop a great deal less than 60 feet behind home plate, a hood sloping 15 degrees toward the field should be installed. (See Figure 1.)

Turf has been the ideal surface for the unskinned areas, although artificial turf is now challenging the traditional construction. Natural turf areas should be a mixture of natural earth and sand, clay, or loam. The pitcher's mound should be largely of clay and is, by rule, required to be 15 inches above the baseline level. Fixed hollow posts should be driven beneath the bases to secure them.

A 2-percent slope from the pitcher's plate to the outfield facilitates drainage. Subsurface drainage in the direction of the slope is considered indispensable to good playing conditions.

Seating should parallel home-to-first and home-to-third base lines.

To provide the most satisfactory vision for the most players, the layout of the diamond should be such that a line between home plate and second base intersects the path of the sun at right angles. If home plate faces south, the late-afternoon sun will be behind the first baseman.

JUNIOR BASEBALL

Junior baseball facilities are similar to baseball, except that the playing area may be reduced, depending upon the age of the participants. Some national organizations that sponsor junior baseball programs have modified the official baseball rules to fit the needs of the players. For example, the distance between bases is shortened as are the distances from home base to the outfield fences and from home base to the pitcher's plate. For these and other dimensions refer to Figure 2.

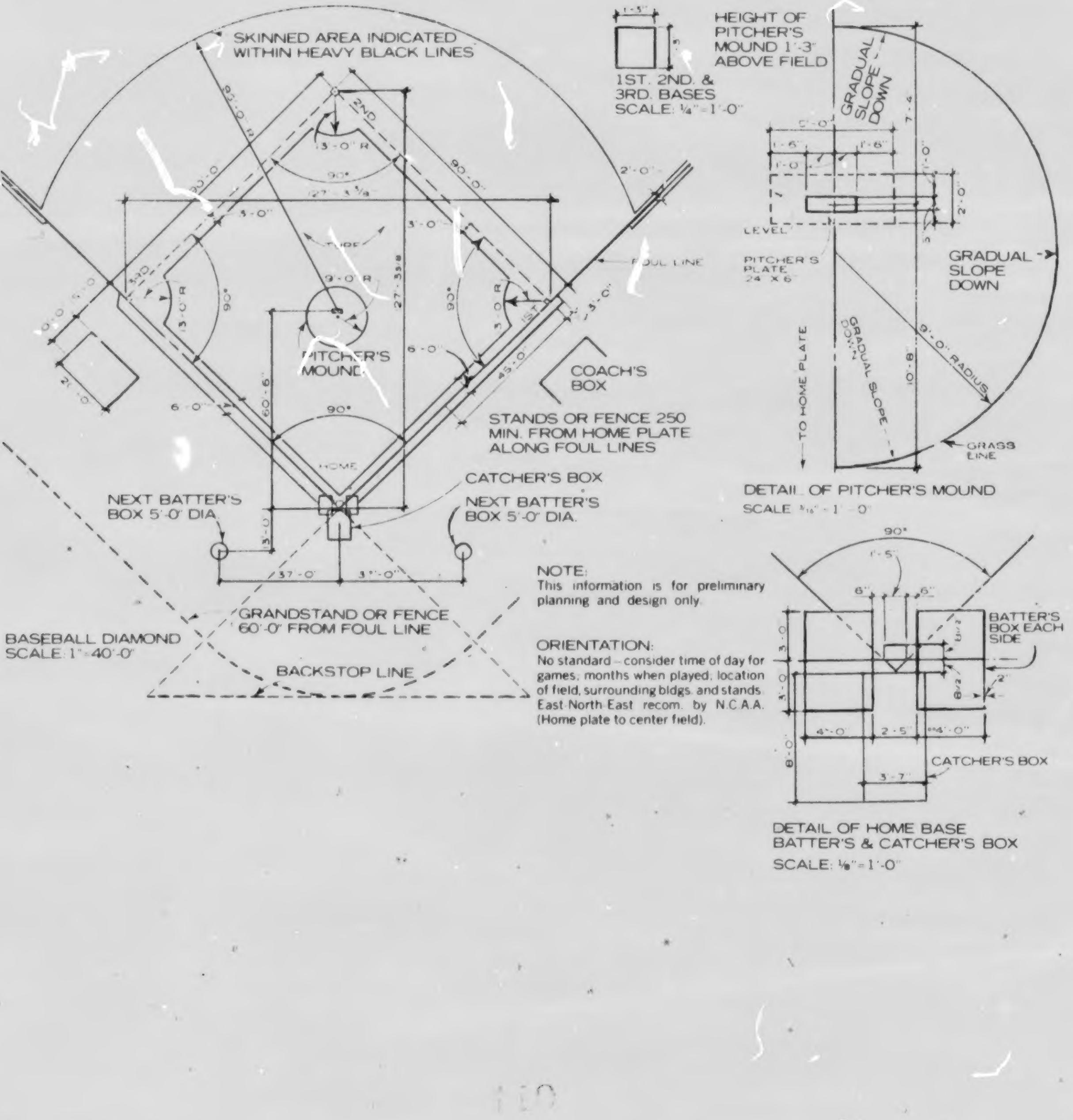
INDOOR BASEBALL

Indoor baseball is played in an arena, field house, or other enclosed space. The concept is growing in popularity, particularly in geographical areas that have a short outdoor spring season. Rubber-coated baseballs are often used, although all other equipment should meet standard requirements. Ample safety netting should separate the bleachers from the playing field. Field dimensions are necessarily modified to suit the amount of space allotted (See Figure 3).

Softball

Softball is a team game played on turf and/or skinned fields. It appeals to practically all age groups. An area of 275 by 275 feet is generally specified.

The game is very similar to baseball, but the field space needed is usually smaller. For men, the distance between bases is 60 feet and the pitcher's plate is 46 feet from the apex of home plate. For girls and women, the distance


SKINNED AREA INDICATED WITHIN HEAVY BLACK LINES
95'-0" R
2ND
13'-0" R
90'-0"
90'-0"
90°
127'-3 3/8"
2'-0"
3'-0"
3'-0"
TURF
3RD
9'-0" R
127'-3 3/8
90°
90°
13'-0" R
13'-0" R
1ST
3'-0"
FOUL LINE
PITCHER'S MOUND
6'-0"
45'-0"
COACH'S BOX
6'-0"
60'-6"
90°
STANDS OR FENCE 250 MIN. FROM HOME PLATE ALONG FOUL LINES
HOME
CATCHER'S BOX
NEXT BATTER'S BOX 5'-0" DIA.
NEXT BATTER'S BOX 5'-0" DIA.
15'-0"
37'-0"
37'-0"
20'-0"
GRANDSTAND OR FENCE 60'-0" FROM FOUL LINE
BASEBALL DIAMOND
SCALE: 1"=40'-0"
BACKSTOP LINE
1'-3"
1ST. 2ND. & 3RD. BASES
SCALE: 1/4"=1'-0"
HEIGHT OF PITCHER'S MOUND 1'-3" ABOVE FIELD
GRADUAL SLOPE DOWN
7'-4"
5'-0"
1'-6"
1'-6"
1'-0"
1'-0"
2'-0"
LEVEL
PITCHER'S PLATE 24" X 6"
GRADUAL SLOPE DOWN
TO HOME PLATE
GRADUAL SLOPE DOWN
10'-8"
9'-0" RADIUS
GRASS LINE
DETAIL OF PITCHER'S MOUND
SCALE 3/16" = 1'-0"
90°
1'-5"
6"
6"
BATTER'S BOX EACH SIDE
3'-0"
3'-0"
2"
4'-0"
2'-5"
4'-0"
8'-0"
CATCHER'S BOX
3'-7"
DETAIL OF HOME BASE BATTER'S & CATCHER'S BOX
SCALE: 1/8"=1'-0"

NOTE:
This information is for preliminary planning and design only.

ORIENTATION:
No standard – consider time of day for games; months when played; location of field, surrounding bldgs. and stands. East-North-East recom. by N.C.A.A. (Home plate to center field).

Figure 1. Baseball.

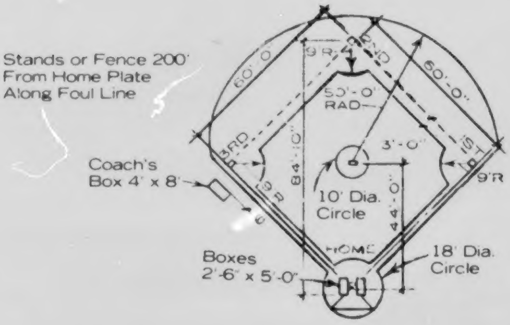
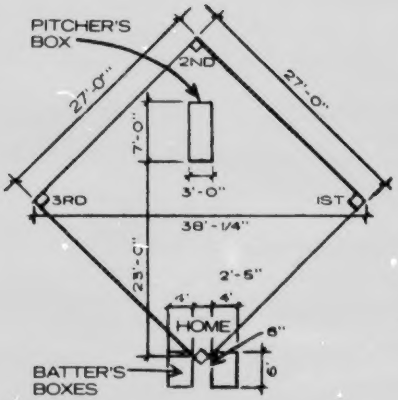
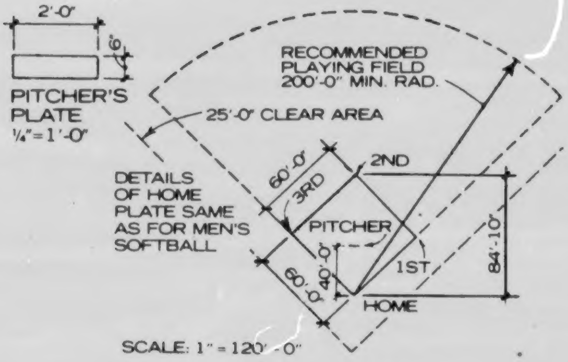

Stands or Fence 200' From Home Plate Along Foul Line
60'-0"
60'-0"
9'R
2ND
50'-0" RAD
3RD
1ST
84'-10"
3'-0"
9'R
Coach's Box 4' x 8'
10' Dia. Circle
44'-0"
HOME
Boxes 2'-6" x 5'-0"
18' Dia. Circle

Figure 2. Junior or Little League Baseball.

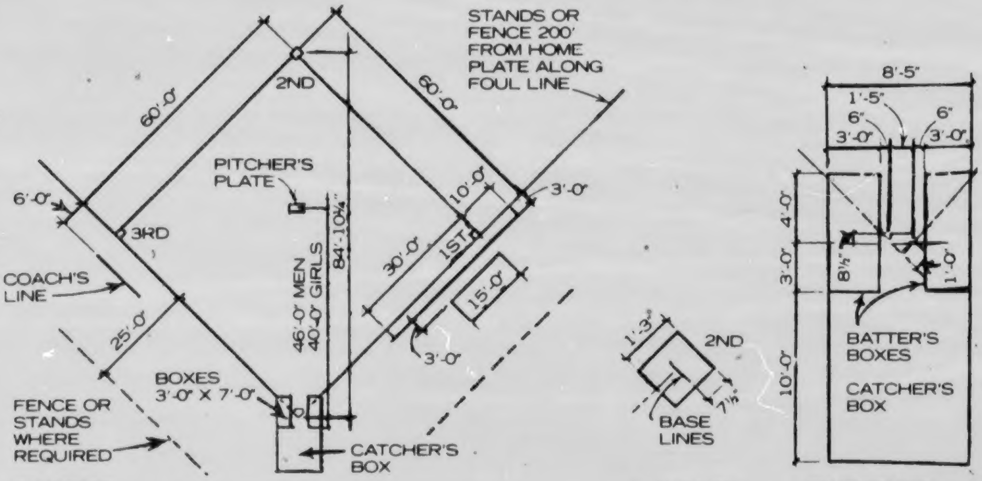

PITCHER'S BOX
2ND
27'-0"
27'-0"
7'-0"
3'-0"
3RD
1ST
38'-1/4"
23'-0"
2'-5"
4'
4'
HOME
8"
6'
BATTER'S BOXES

SCALE: 1"=20'-0"
Charles F. D. Egbert, AIA; Architect; Washington, D.C.

Figure 3. Indoor Baseball.


2'-0"
6"
PITCHER'S PLATE
¼"=1'-0"
RECOMMENDED PLAYING FIELD 200'-0" MIN. RAD.
25'-0" CLEAR AREA
DETAILS OF HOME PLATE SAME AS FOR MEN'S SOFTBALL
60'-0"
3RD
2ND
PITCHER
40'-0"
1ST
84'-10"
60'-0"
HOME

SCALE: 1" = 120' - 0"


STANDS OR FENCE 200' FROM HOME PLATE ALONG FOUL LINE
2ND
60'-0"
60'-0"
PITCHER'S PLATE
6'-0"
3RD
10'-0"
3'-0"
84'-10¼"
1ST
30'-0"
46'-0" MEN
40'-0" GIRLS
COACH'S LINE
15'-0"
25'-0"
3'-0"
BOXES 3'-0" X 7'-0"
FENCE OR STANDS WHERE REQUIRED
CATCHER'S BOX
1'-3"
2ND
7½"
BASE LINES
8'-5"
1'-5"
6"
6"
3'-0"
3'-0"
4'-0"
3'-0"
8½"
1'-0"
BATTER'S BOXES
CATCHER'S BOX
10'-0"

DIAMOND
SCALE: 1"=40'-0"

2ND BASE
SCALE: 1"=4'-0"

HOME BASE
SCALE: 1"=10'-0"

Figure 4. Softball.

between bases is 45 feet and the pitcher's plate is 38 feet from the back end of home plate. (See Figure 4.)

The 12-inch ball is larger than a baseball but is equally hard. The pitcher must pitch with an underhand motion. Nine players are on each team. A hooded backstop is commonly installed for recreational and intramural league play.

Slow-pitch softball is a modified version of softball geared to unskilled players. The ball is larger (16-inch circumference for boys, 14-inch for girls), and the pitcher must throw the ball in a high arch. Bases are 50 feet apart for men and 45 feet apart for girls. The distance between the pitcher's mound and home plate is 35 feet.

RUNNING AND TOSSING TRACKS/FIELDS

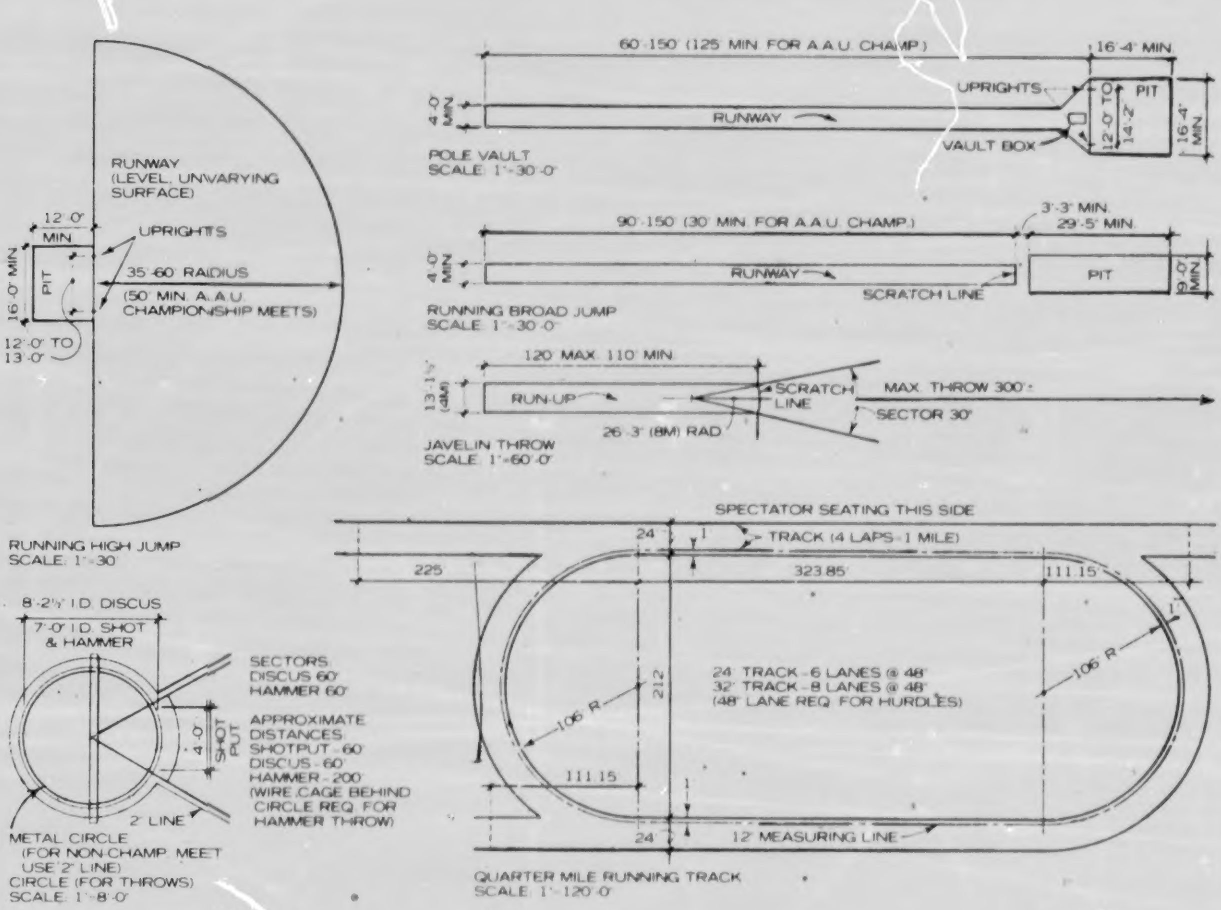
Track and Field

Track events are generally conducted on a quarter-mile running track with a minimum straightaway of 140 yards to a maximum of 240 yards. The individual running events include dashes, distance events, and hurdles (low and high). In addition to the individual running events, there are relay events in which there are four runners on a team.

The track, the surface of which is composed of cinders or synthetic material, should be flat. Track rules require that there be a two-inch solid curb constructed around the interior of the track. This curb may be made of wood, concrete, asphalt, or steel. Inclination of the track should be limited to the ratio of 1:100 laterally and 1:1,000 in the running direction (for field events, in the jumping or throwing direction). Most tracks are constructed so that lateral inclination is toward the inside curb, where small scuppers permit the water to drain from the track to the edge of the infield.

The track should contain at least six lanes. These lanes should be at least 36 inches wide, but a width of 42 to 48 inches is preferred. They should be marked with materials not injurious to the eyes or skin.

Field events to be considered in planning track and field areas and facilities are road walk; steeplechase; high, broad, and triple jump events; discus; shot-put; javelin; and pole



60'-150' (125' MIN. FOR A.A.U. CHAMP.)
16'-4" MIN.
UPRIGHTS
PIT
4'-0" MIN.
RUNWAY
12'-0" TO 14'-2"
16'-4" MIN.
VAULT BOX
POLE VAULT
SCALE: 1"-30'-0"
RUNWAY
(LEVEL, UNVARYING SURFACE)
12'-0" MIN.
UPRIGHTS
16'-0" MIN.
PIT
35'-60' RADIUS
(50' MIN. A.A.U. CHAMPIONSHIP MEETS)
12'-0" TO 13'-0"
RUNNING HIGH JUMP
SCALE: 1"-30'
3'-3" MIN.
90'-150' (30' MIN. FOR A.A.U. CHAMP.)
29'-5" MIN.
4'-0" MIN.
RUNWAY
PIT
9'-0" MIN.
SCRATCH LINE
RUNNING BROAD JUMP
SCALE: 1"-30'-0"
120' MAX. 110' MIN.
13'-1½" (4M)
RUN-UP
SCRATCH LINE
MAX. THROW 300'±
SECTOR 30°
26'-3" (8M) RAD.
JAVELIN THROW
SCALE: 1"-60'-0"
SPECTATOR SEATING THIS SIDE
24'
1'
TRACK (4 LAPS-1 MILE)
225'
323.85'
111.15'
8'-2½" I.D. DISCUS
7'-0" I.D. SHOT & HAMMER
SECTORS
DISCUS 60°
HAMMER 60°
APPROXIMATE DISTANCES
SHOTPUT - 60'
DISCUS - 60'
HAMMER - 200'
(WIRE CAGE BEHIND CIRCLE REQ. FOR HAMMER THROW)
4'-0"
SHOT PUT
2" LINE
METAL CIRCLE
(FOR NON-CHAMP. MEET USE 2" LINE)
CIRCLE (FOR THROWS)
SCALE: 1"-8'-0"
106' R
212'
24' TRACK - 6 LANES @ 48"
32' TRACK - 8 LANES @ 48"
(48" LANE REQ. FOR HURDLES)
106' R
1'
111.15'
1'
24'
12" MEASURING LINE
QUARTER MILE RUNNING TRACK
SCALE: 1"-120'-0"

Figure 5. Track and Field.

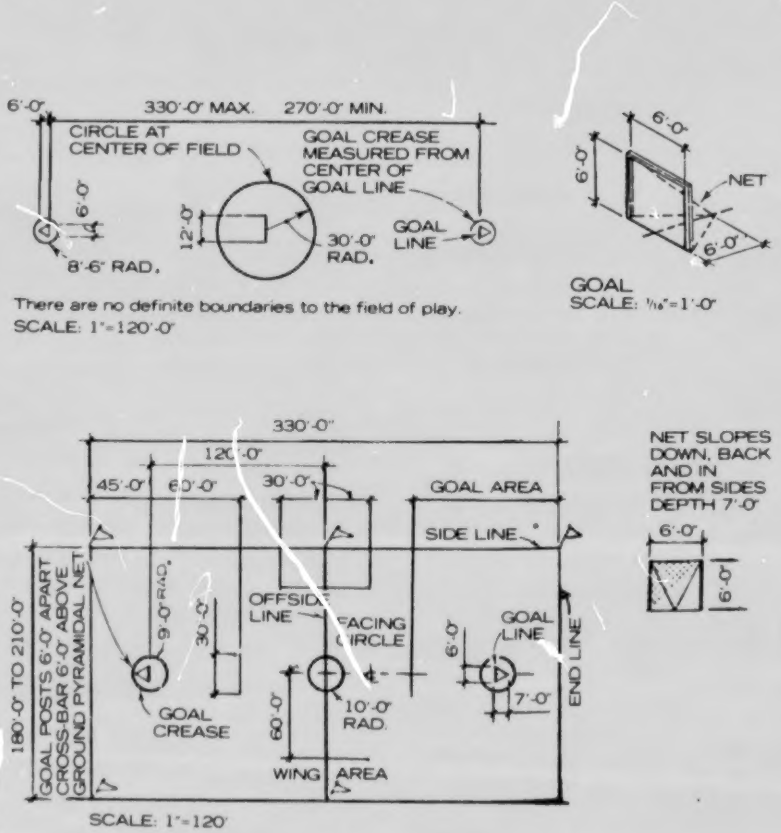

6'-0"
330'-0" MAX.
270'-0" MIN.
CIRCLE AT CENTER OF FIELD
GOAL CREASE MEASURED FROM CENTER OF GOAL LINE
6'-0"
12'-0"
30'-0" RAD.
GOAL LINE
8'-6" RAD.
There are no definite boundaries to the field of play.
SCALE: 1"=120'-0"
6'-0"
6'-0"
NET
6'-0"
GOAL
SCALE: 1/16"=1'-0"
330'-0"
120'-0"
45'-0"
60'-0"
30'-0"
GOAL AREA
SIDE LINE
180'-0" TO 210'-0"
GOAL POSTS 6'-0" APART
CROSS-BAR 6'-0" ABOVE
GROUND PYRAMIDAL NET
9'-0" RAD.
30'-0"
OFFSIDE LINE
FACING CIRCLE
6'-0"
GOAL LINE
GOAL CREASE
60'-0"
10'-0" RAD.
7'-0"
END LINE
WING AREA
SCALE: 1"=120'
NET SLOPES DOWN, BACK AND IN FROM SIDES DEPTH 7'-0"
6'-0"
6'-0"

Figure 6. Lacrosse.

vault. A raised landing platform covered with huge chunks of foam rubber is generally placed over the pole-vault landing pit so that the competitor does not have so far to fall when landing. In the high-jump pit, this same safety device is sometimes used, with the landing platform placed closer to the landing pit.

For field events in which the competitors must land in a pit, the landing area must be filled with sawdust or other soft material to protect the participants. The landing pit for the running broad jump and triple jump must have a minimum width of 9 feet and a minimum length of 15 feet. The scratch line for the broad jump is approximately 12 feet from the nearer edge of the landing pit. For the triple jump, the scratch line should be placed at least 36 feet from the near edge of the landing pit. The high-jump and pole-vault landing pit(s) must be not less than 16 feet wide and 12 feet long. (See Figure 5.)

Cross Country

Cross country is an individual or team distance-running event. Race courses vary from 1.5 to 6 miles, depending upon age and level of competition. The course should not exceed 3 miles for senior high school participants.

The running course is usually established in such areas as large community or county parks. Turf fields, hiking trails, and golf courses provide suitable course areas, although relatively unused public areas provide the best conditions. Red, white, and blue flags posted at intersections indicate the course direction for participants.

SPORT FIELDS

Lacrosse

Lacrosse is an increasingly popular team sport requiring agility and skill. It is played on a multipurpose turf or loam field.

The inside dimensions of the field for men are 330 by 210 feet. There are no definite boundaries, but goals must be placed not less than 270 nor more than 330 feet apart. The minimum width is 50 feet.

The goals lie on the 15-yard lines at each end of the field. These goals consist of two square posts six feet apart and joined at the top by a rigid crossbar seven feet (six feet for women) above the ground (all inside dimensions). The posts are two by two inches, wood painted white. Netting of not more than 1.5-inch mesh must be attached to the posts and crossbar and to a point seven feet (six feet for women) behind the center of the goal. The net is firmly pegged to the ground. A line called the goal line is drawn from post to post.

Orientation, surface, and grading are the same as for football. A five- or six-foot barrier fence at least 10 feet outside the end and sidelines is recommended. (See Figure 6.)

Cricket

Cricket is a team sport utilizing a bat or racket and a core-centered ball. It is played by 22 persons at a time.

The game can be played on a multipurpose field 500 to 550 feet in length and 450 to 520 feet in width, clear of obstructions. The direction of play should be north and south, perpendicular to the sun's path. The field of close-cropped turf should have good subsurface drainage, with the ground pitching away from a flat area 40 feet square in the center of the game area.

Two wickets are set up in the middle of the field, 66 feet apart. The wicket consists of three upright pieces of wood, known as stumps, each 27 inches high, on which are placed two short pieces of wood set in grooves in the top of the upright so as not to project more than a half inch above them. Lines are marked at and in front of each wicket, known respectively as bowling creases and popping creases. Popping creases are marked four feet in front of the wickets, parallel to it and unlimited in length. Bowling creases are in line with the stumps, eight feet, eight inches long including the stumps in the center. The batsmen stand between these creases when striking the ball. (See Figure 7.)

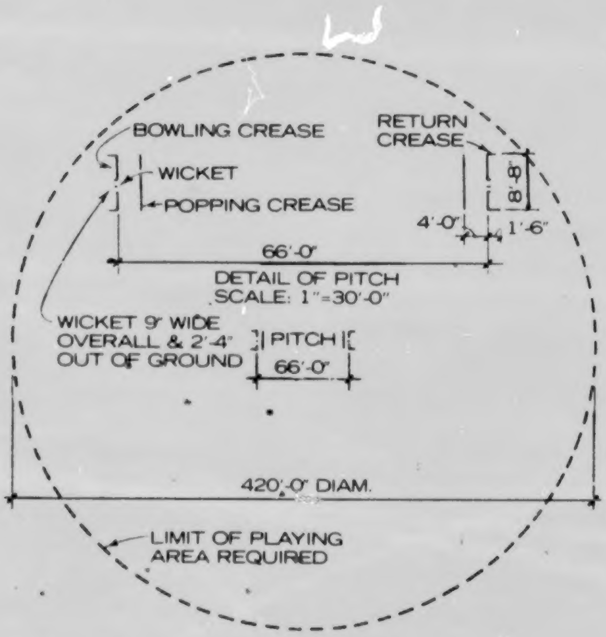


Figure 7. Cricket.

Touch Football

Touch football is a game in which the player touches rather than tackles an opponent. The game involves more passing and outside running than football since all players are eligible to receive a pass. A team consists of six or nine players. Any number of players from four to eleven may be used, however, by mutual consent. It is played mostly in classes, intramurals, and recreational programs on the community park-school and college levels.

The field area is the same as for regular football, but yard stripes are drawn 10 yards apart. The field may be made shorter for class play if space is limited. (See Figure 8.)

Soccer

Soccer is a fast-moving team game in which players use the head and feet to propel the ball. It may be played in classes and in interscholastic, intercollegiate, intramural, and other forms of recreational competition. Its popularity is growing rapidly in the United States.

There are 11 players on a team. The object is to kick or "head" the ball through the opponent's goal, which is protected by a "goalie" who may use his hands.

The field dimensions are 360 by 240 feet for boys and men, 300 by 180 feet for college women, and 240 by 120 feet for high school girls. The field should be oriented so that play is in a north-and-south direction. White side and end lines should be two inches wide. If lime is used, it should be thoroughly slaked. All dimensions are inside the line measurements. (See Figure 9.)

The distance between goal posts is 24 feet inside measurement. The height of the crossbar is eight feet, measured to its lower edges. Stock posts four by five or five by five inches, painted white, are specified for the goal posts. For goals on women's playing fields, see Figure 16.

The surface should be level turf or loam. Lighting for night use is desirable where high interest exists.

Football and Other Large-Field Sports

Football is a highly competitive contact team sport played with an inflated ball on a field 360 by 160 feet or smaller, depending on the number of players on a team (6, 8, or 11). Each player is uniformed with protective equipment.

The goal posts are 18.5 feet apart and 20 feet high. The crossbar is 10 feet above the ground.

Lines should be marked with a material that is not injurious to the eyes or skin. No lime or caustic material of any kind may be used. Measurements are from the inside edges of the boundary lines.

Flags with flexible shafts should be installed at each intersection of the sidelines and goal lines, and on the end lines 53 feet, four inches toward the goal posts from the intersections of the sidelines and end lines. The field should be crowned down the center, sloping one-fourth inch per foot toward the sidelines. (See Figure 10.)

The junior football game is an example of a team game that has been adapted from regulation football for use by young boys between 11 and 16. There are usually 6, 8, or 11 players on a team. The game is usually played on a multipurpose field. Junior football may be included in a class, intramural, or recreational program.

The field should be oriented so that play is in a north-and-south direction. The field should have the same construction features as a regulation football field, including team benches, goal posts, and a scoreboard.

Gaelic football is a European game much like today's American football. Its field can be used for hurling as well. (See Figure 11.)

Rugby is also a fast-moving field game similar to football. (See Figure 12.)

For dimensions of a polo field, see Figure 13.

Field Hockey

Field hockey is a field game in which the 11 players on each team use hockey sticks (curved-base stick with one flat surface) to propel a small, white, leather-covered ball.

The game may be played on a multipurpose turf or loam field 100 yards long and from 50 to 60 yards wide; 85 by 45 yards for younger players. The field is marked with

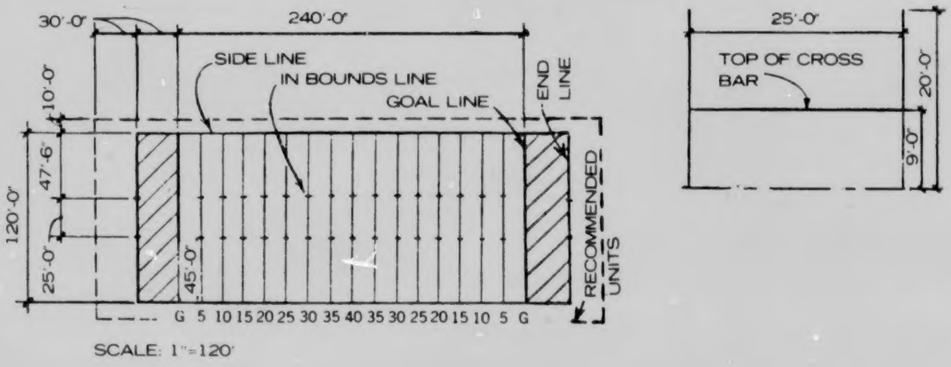
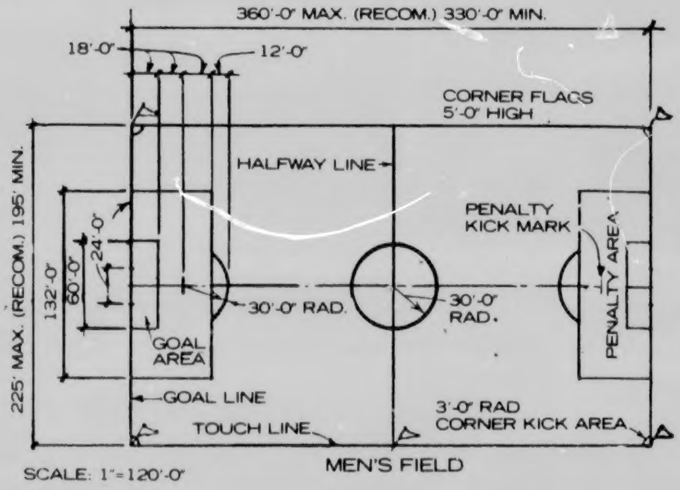
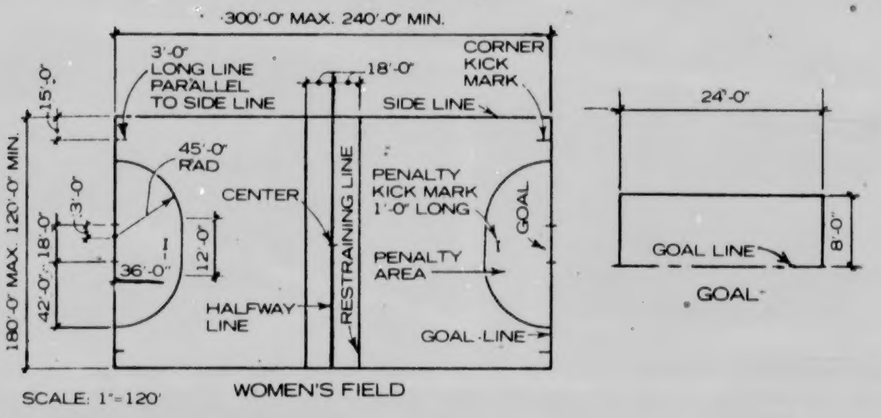

30'-0"
240'-0"
SIDE LINE
IN BOUNDS LINE
GOAL LINE
END LINE
10'-0"
47'-6"
120'-0"
25'-0"
45'-0"
RECOMMENDED UNITS
G 5 10 15 20 25 30 35 40 35 30 25 20 15 10 5 G
SCALE: 1"=120'
25'-0"
TOP OF CROSS BAR
20'-0"
9'-0"

Figure 8. Touch (or Six-Person) Football.


360'-0" MAX. (RECOM.) 330'-0" MIN.
18'-0"
12'-0"
CORNER FLAGS 5'-0" HIGH
HALFWAY LINE
PENALTY KICK MARK
PENALTY AREA
225' MAX. (RECOM.) 195' MIN.
132'-0"
60'-0"
24'-0"
30'-0" RAD.
30'-0" RAD.
GOAL AREA
GOAL LINE
TOUCH LINE
3'-0" RAD CORNER KICK AREA
SCALE: 1"=120'-0"

MEN'S FIELD


300'-0" MAX. 240'-0" MIN.
3'-0" LONG LINE PARALLEL TO SIDE LINE
18'-0"
CORNER KICK MARK
SIDE LINE
15'-0"
45'-0" RAD
CENTER
RESTRAINING LINE
PENALTY KICK MARK 1'-0" LONG
GOAL
3'-0"
18'-0"
12'-0"
36'-0"
PENALTY AREA
180'-0" MAX. 120'-0" MIN.
42'-0"
HALFWAY LINE
GOAL LINE
SCALE: 1"=120'
24'-0"
8'-0"
GOAL LINE
GOAL

WOMEN'S FIELD

Figure 9. Soccer.

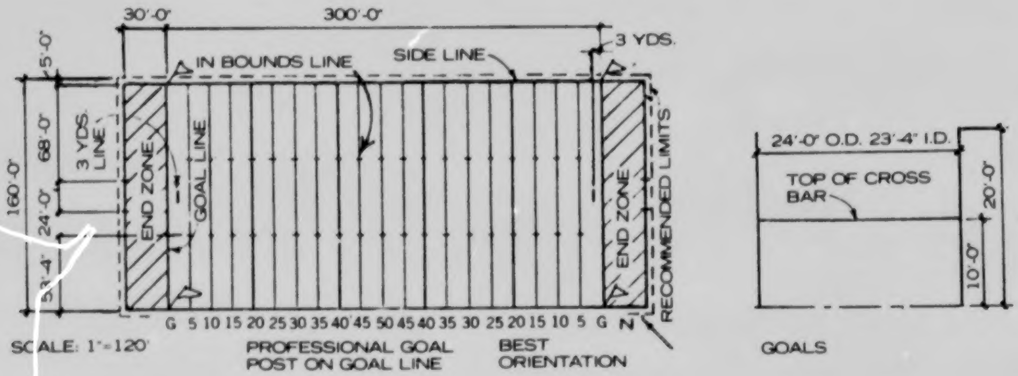

30'-0"
300'-0"
3 YDS.
5'-0"
IN BOUNDS LINE
SIDE LINE
160'-0"
68'-0"
24'-0"
53'-4"
3 YDS. LINE
END ZONE
GOAL LINE
END ZONE
RECOMMENDED LIMITS
G 5 10 15 20 25 30 35 40 45 50 45 40 35 30 25 20 15 10 5 G
N
SCALE: 1"=120'
PROFESSIONAL GOAL POST ON GOAL LINE
BEST ORIENTATION
24'-0" O.D. 23'-4" I.D.
TOP OF CROSS BAR
20'-0"
10'-0"
GOALS

Figure 10. Football.

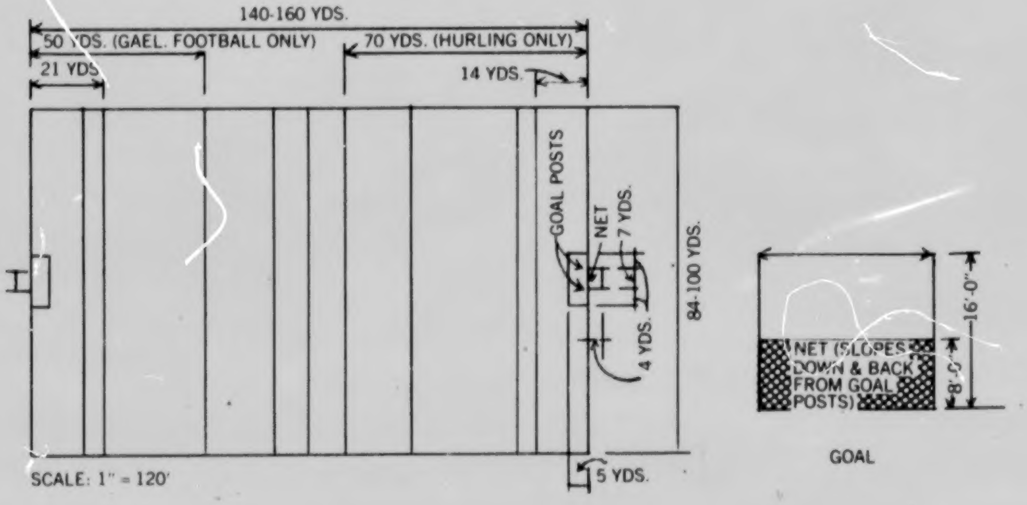

140-160 YDS.
50 YDS. (GAEL. FOOTBALL ONLY)
70 YDS. (HURLING ONLY)
21 YDS.
14 YDS.
GOAL POSTS
NET
7 YDS.
4 YDS.
84-100 YDS.
SCALE: 1" = 120'
5 YDS.
16'-0"
NET (SLOPES DOWN & BACK FROM GOAL POSTS)
8'-0"
GOAL

Figure 11. Gaelic Football and Hurling.

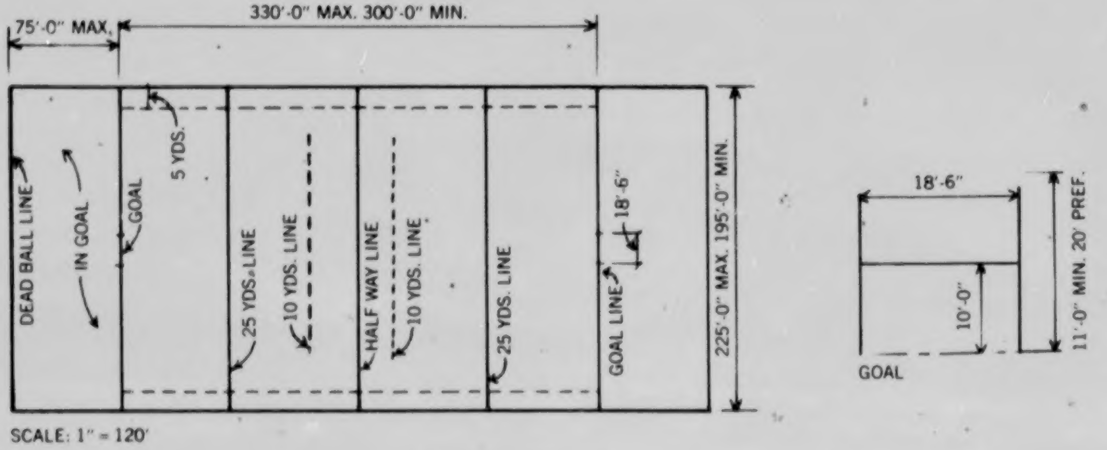

75'-0" MAX.
330'-0" MAX. 300'-0" MIN.
DEAD BALL LINE
IN GOAL
GOAL
5 YDS.
25 YDS. LINE
10 YDS. LINE
HALF WAY LINE
10 YDS. LINE
25 YDS. LINE
GOAL LINE
18'-6"
225'-0" MAX. 195'-0" MIN.
SCALE: 1" = 120'
18'-6"
10'-0"
11'-0" MIN. 20' PREF.
GOAL

Figure 12. Rugby.

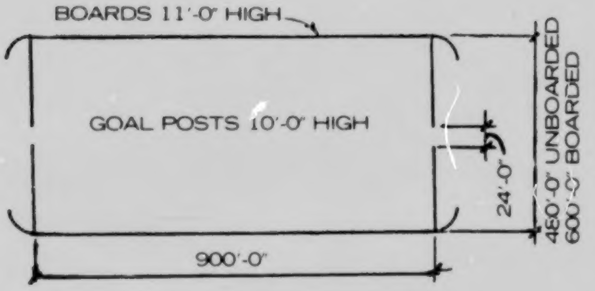


Figure 13. Polo.

two-inch white lines. On the larger-size field, the lines should divide the length of the field into four equal parts 25 yards apart. Where fields are smaller, the 25-yard lines should be 25 yards from the goal lines, the five yard lines five yards from the sidelines, and the striking circles should be regulation size. For experienced players, the division lines need only to be extended seven yards from the sideline. For men, the alleys should be seven yards wide instead of five. All dimensions are inside the lines. The goal posts should be two by three inches and painted white. Goal posts are located on the center of the goal line, 12 feet apart. The posts are joined by a cross bar seven feet above the ground. (See Figure 14.)

Grading, surfacing, drainage, and orientation are the same as for the football field described above.

Speedball

Speedball is a vigorous team sport played on an area 160 by 300 feet. The game combines the skills of soccer and basketball. It requires goal posts, end zones, and a soccer ball.

This sport is used as a class, intramural, recreational, and competitive activity. There are seven or nine players to a team.

The size of the field should be reduced for young players and for intramural activities. A multipurpose field or soccer field can be adapted to the game. Markings should be laid out on the field with noncaustic powder or tape. It is important that the field be well-drained. (See Figure 15.)

Field Ball

In field ball, goals are similar to soccer goals but with upright posts 11 feet high. A penalty free-throw mark is made opposite each goal, 12 yards from its center. (See Figure 16.)

BOWLING AND TOSSING COURTS

Horseshoes

This game is played either individually or in teams of two and requires tossing of "horseshoes." It may be included in programs for class instruction, intramurals and other competitions, and recreation. Persons of nearly all ages may participate, both during the day and in the evening where night lighting is provided.

Horseshoe courts require a space 60 feet long and as wide as is necessary to accommodate pitching stations 10 feet apart and leave 10 feet on each side of the total area. The area should be protected by a fence or low pipe rail. If spectator benches are provided at the ends, a protective fence will be required.

The courts should be level and the pegs placed at the proper angle for championship play. The stakes should be one inch in diameter and three feet long, should extend 14 inches above the top of the box, and each should incline three inches toward the other. They should be 40 feet apart for men and 30 feet for women and for boys under 16 years of age. A surfaced walkway between stakes is desirable. The courts should be oriented so that play is in a north-and-south direction. (See Figure 17.)

Boccie

Boccie is an individual or dual court game, adapted from bowling and originating in Italy. All ages play the game in numbers of two or four.

The court dimensions are 75 by 15 feet. It is generally preferable to play the game in the shade in an area remote from the play areas for younger children. Lighting for night use is desirable. It is recommended that an additional three feet at the sides and nine feet at the ends be provided as minimum buffer areas. The surface should be level and should contain a mixture of sand and clay (loam). (See Figure 18.)

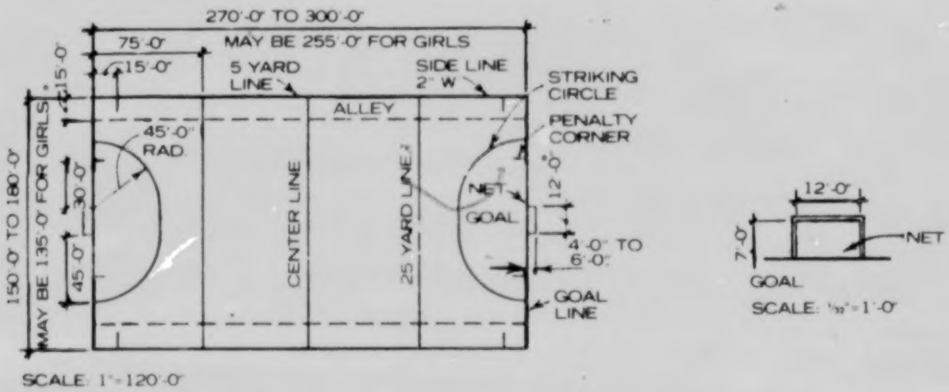


Figure 14. Field Hockey.

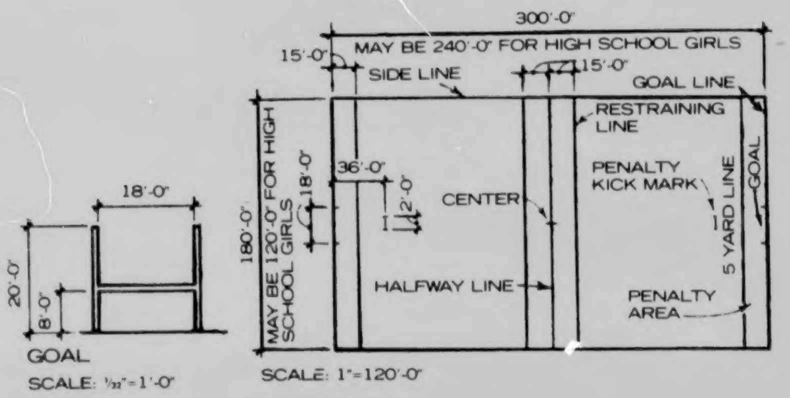

18'-0"
20'-0"
8'-0"
GOAL
SCALE: 1/32"=1'-0"
300'-0"
MAY BE 240'-0" FOR HIGH SCHOOL GIRLS
15'-0"
SIDE LINE
15'-0"
GOAL LINE
RESTRAINING LINE
180'-0"
MAY BE 120'-0" FOR HIGH SCHOOL GIRLS
18'-0"
36'-0"
2'-0"
CENTER
PENALTY KICK MARK
5 YARD LINE
GOAL
HALFWAY LINE
PENALTY AREA
SCALE: 1"=120'-0"

Figure 15. Speedball.

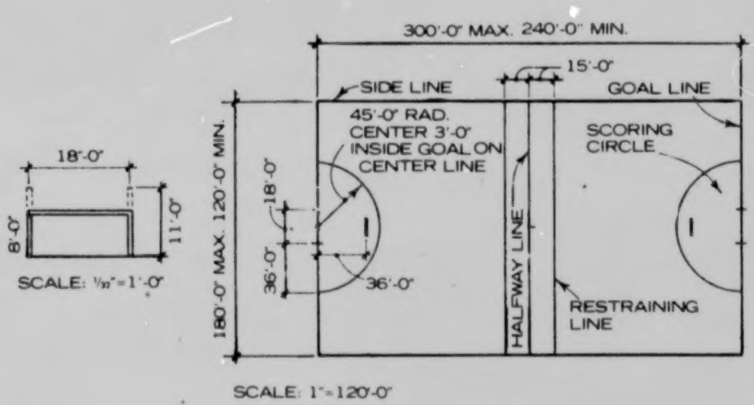

18'-0"
8'-0"
11'-0"
SCALE: 1/32"=1'-0"
300'-0" MAX. 240'-0" MIN.
15'-0"
SIDE LINE
GOAL LINE
45'-0" RAD. CENTER 3'-0" INSIDE GOAL ON CENTER LINE
SCORING CIRCLE
180'-0" MAX. 120'-0" MIN.
18'-0"
36'-0"
36'-0"
HALFWAY LINE
RESTRAINING LINE
SCALE: 1"=120'-0"

Figure 16. Field Ball.

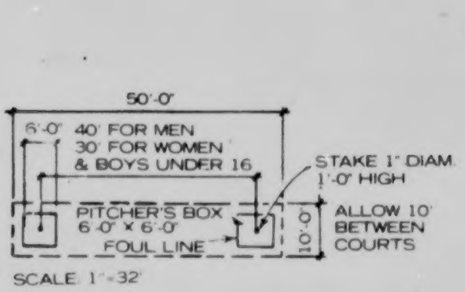

50'-0"
6'-0"
40' FOR MEN
30' FOR WOMEN & BOYS UNDER 16
STAKE 1" DIAM. 1'-0" HIGH
PITCHER'S BOX 6'-0" X 6'-0"
FOUL LINE
10'-0"
ALLOW 10' BETWEEN COURTS
SCALE: 1"=32'

Figure 17. Horseshoes.

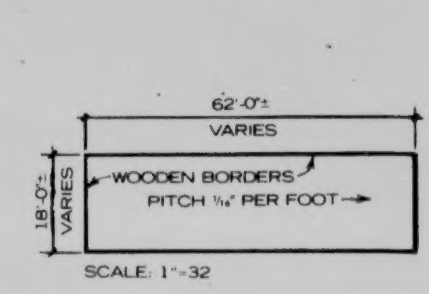

62'-0"±
VARIES
WOODEN BORDERS
PITCH 1/16" PER FOOT
18'-0"±
VARIES
SCALE: 1"=32

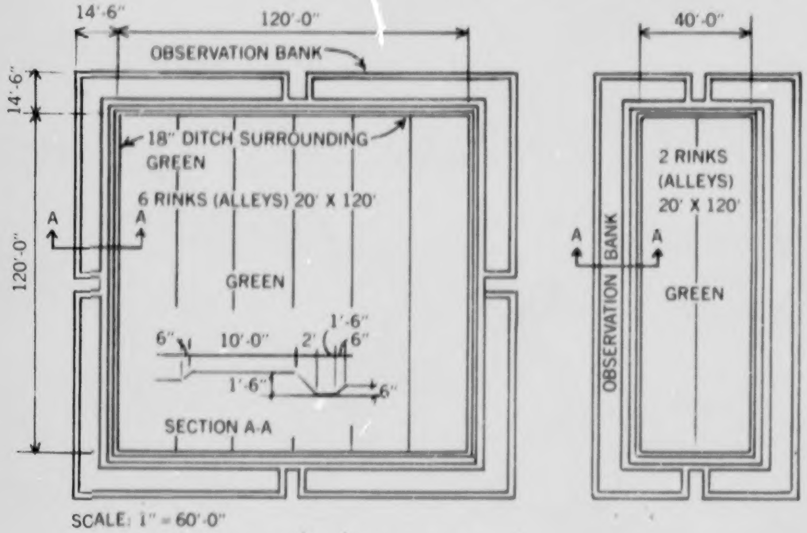
Figure 18. Boccie (or Bocce).

Lawn Bowling

Lawn bowling is a popular sport for men and women of all ages. Little physical effort is required, but skill is essential to roll a bowl properly to the target jack.

The game is played on a 120-by-120-foot bent-grass green or loam surface. The green, which should be located in a quiet section of the recreational area, is divided into eight 14-by-11-foot rinks. Each rink will accommodate two or four players.

The green is surrounded by a depressed ditch or wall with a width of 10 to 15 inches and a depth of two to four inches. A bank at least 18 inches high should be constructed around the green. The ditch and bank are necessary to stop overthrow bowls. (See Figure 19.)



Charles F. D. Egbert, AIA; Architect; Washington, D. C.

Figure 19. Lawn Bowling.

Play should be rotated to avoid excess wearing of the turf on any two sides.

Croquet

Croquet is a court game requiring only mild physical effort. All ages play the game in numbers of two to eight. The activity may be included in class instruction, intramural, and recreational programs at all levels. It is usually played on turf or loam areas.

The court dimensions are 60 by 30 feet. Although the most desirable surface is close-cut turf, the game may be played on a multipurpose area. The surface should be level and the area of play should be defined by a boundary cord secured by six staples. (See Figure 20.)

Roque

Roque is a refined mallet-and-ball game played by teenagers to older adults. Play is on either a paved or clay court area. Most neighborhood and community park-schools and colleges utilize the activity for class instruction, intramurals, and recreation.

The court should be 60 by 30 feet in size and should be smooth, flat, and level. The surface should be of sand-clay mixture or asphalt sprinkled with fine sand. It should be pitched toward the corners to a drainage outlet in the border. This border should be of wood or concrete with an iron rim for better rebound deflection and should be not less than five inches high. A painted or taped boundary line should be 28 inches inside the curb. Steel arches are set into concrete blocks below the surface. (See Figure 21.)

The facility should be placed in the court games area, and unless local conditions demand more, only one should be constructed.

Shuffleboard

Shuffleboard is a popular year-round activity for all age groups. It is played on a smooth concrete, terrazzo, or sealed asphalt surface.

The game is played by pushing discs with a cue to a point-numbered target. The playing area is 52 by 6 feet. Authorities recommend an additional two feet on each end and six feet at each side. It is most economical to construct the courts in batteries of three, with depressed walkways between courts to facilitate drainage. (See Figure 22.)

Shuffleboard may be played by two or four players. It is desirable to locate the courts in a relatively quiet area with some shade. Enjoyment will be increased with the installation of a canopy roof at each end. Night lighting is also feasible.

Quoits

Quoits is an individual or dual game participated in by persons over 10 years of age. It is an excellent coeducational activity. Two or four persons throw a quoit (a circular metal ring four inches in diameter, 2.5 inches wide, and flat on one side) toward flat-headed pins, set flush with the

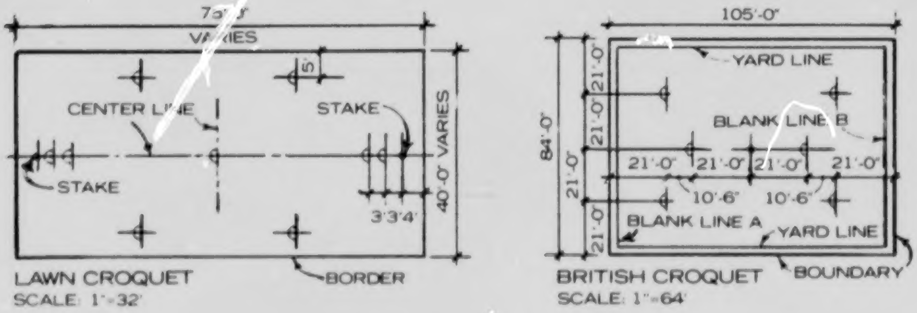

75'-0"
VARIES
5'
CENTER LINE
STAKE
STAKE
40'-0" VARIES
3'3'4'
BORDER
LAWN CROQUET
SCALE: 1"=32'
105'-0"
YARD LINE
BLANK LINE B
84'-0"
21'-0"
21'-0"
21'-0"
21'-0"
21'-0"
21'-0"
21'-0"
21'-0"
10'-6"
10'-6"
BLANK LINE A
YARD LINE
BOUNDARY
BRITISH CROQUET
SCALE: 1"=64'

Figure 20. Croquet.

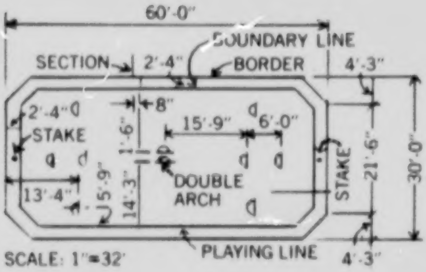

60'-0"
BOUNDARY LINE
SECTION
2'-4"
BORDER
4'-3"
2'-4"
8"
STAKE
15'-9"
6'-0"
1'-6"
STAKE
21'-6"
30'-0"
13'-4"
5'-9"
14'-3"
DOUBLE ARCH
SCALE: 1"=32'
PLAYING LINE
4'-3"

Figure 21. Roque.

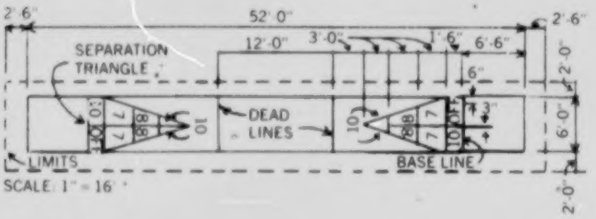

2'-6"
52'-0"
2'-6"
SEPARATION TRIANGLE
12'-0"
3'-0"
1'-6"
6'-6"
2'-0"
6"
10
8
7
DEAD LINES
3"
6'-0"
LIMITS
BASE LINE
SCALE: 1"=16'
2'-0"

Figure 22. Shuffleboard.

ground in a ring four feet in diameter at each end of the court. Calipers are used to measure the distance from quoit to pin.

The game is played outdoors on a paved or turf area. For women and children, the court dimensions are 12 by 44 feet, and the pitching distance between pins (stakes) should be 30 feet. For men, the stakes should be 54 feet apart in a court space of 25 feet by 80 feet. The court should be oriented so that play is in a north-and-south direction in order that the players' line of sight is away from the sun's path. (See Figure 23.)

The court should be on a well-drained sanded or turf area pitched at least one-eighth inch per foot. The circular ring should be of stiff clay at least six inches deep. Wood foul lines should be perpendicular to the line of play, bisecting the circular ring. The entire court should be fenced or shrubbed with low border plantings to prevent people from cutting through the court area and for control and supervision purposes. Lighting could be provided for night play.

Volleyball

Volleyball is a team game utilizing the hands to propel the ball over a net. The game may be played in class, intramural, interscholastic, intercollegiate, and recreational competition. Twelve people are needed to play a game. It is an excellent coeducational activity.

The court is 60 by 30 feet (outside dimensions) and should be oriented so that play is in a north-and-south direction (See Figure 24). It may be located on a multipurpose macadam or clay-loam surfaced area. The surface should be sloped from sideline to sideline, allowing one-eighth inch per foot for drainage. Two or more courts should be planned according to anticipated needs.

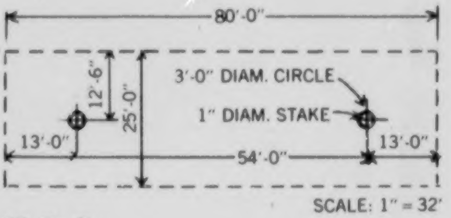

80'-0"
12'-6"
25'-0"
3'-0" DIAM. CIRCLE
1" DIAM. STAKE
13'-0"
13'-0"
54'-0"
SCALE: 1" = 32'

Figure 23. Quoits.

Goal Hi

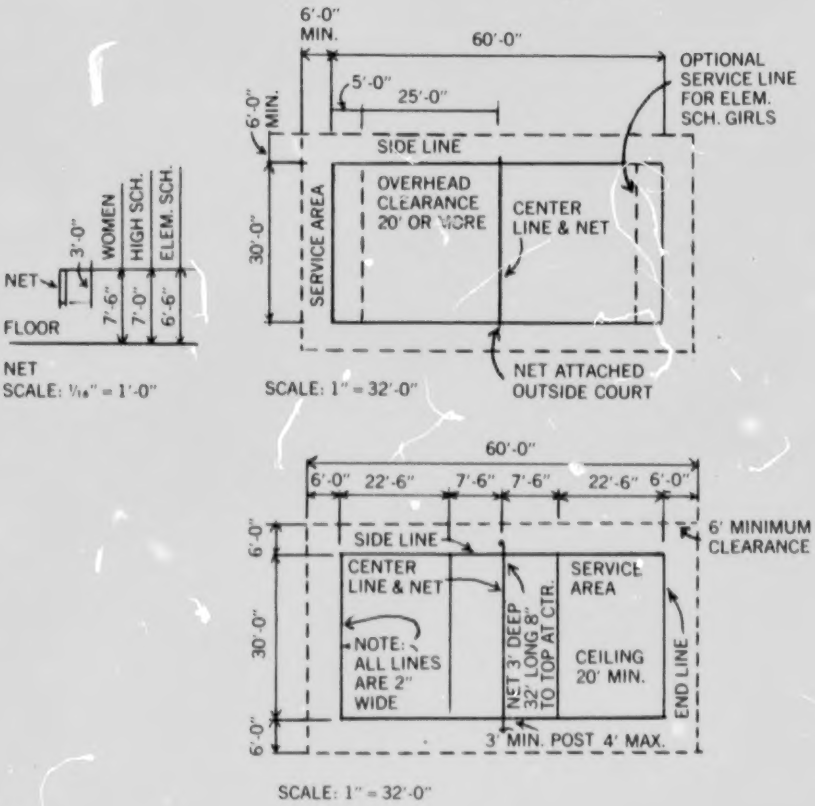
Goal hi is an adaptation of basketball. The court contains a single goal in the center. The basket consists of a metal 18-inch ring, supported by three curved braces that form a three-way chute. The court is a firm level grade and is marked by an outside boundary line, a free-throw line, and a restraining line. (See Figure 25.)

Basketball

Basketball is a particularly popular, fast-running team game, played on a rectangular court. Ability to shoot the ball through a ring basket is the key skill, although a coordinated team effort is generally vital for success.

This sport is commonly played by upper elementary, junior high, and senior high school as well as college-age groups. Boys or girls may play, but with different rules.

Basketball can be played outdoors or indoors, but "varsity" games are generally played indoors. Outdoor


6'-0" MIN.
60'-0"
5'-0"
25'-0"
OPTIONAL SERVICE LINE FOR ELEM. SCH. GIRLS
6'-0" MIN.
SIDE LINE
OVERHEAD CLEARANCE 20' OR MORE
CENTER LINE & NET
30'-0"
SERVICE AREA
NET ATTACHED OUTSIDE COURT
SCALE: 1" = 32'-0"
3'-0"
WOMEN
HIGH SCH.
ELEM. SCH.
NET
7'-6"
7'-0"
6'-6"
FLOOR
NET
SCALE: 1/16" = 1'-0"
60'-0"
6'-0"
22'-6"
7'-6"
7'-6"
22'-6"
6'-0"
6' MINIMUM CLEARANCE
6'-0"
SIDE LINE
CENTER LINE & NET
SERVICE AREA
NET 3' DEEP 32' LONG 8" TO TOP AT CTR.
30'-0"
NOTE: ALL LINES ARE 2" WIDE
CEILING 20' MIN.
END LINE
6'-0"
3' MIN. POST 4' MAX.
SCALE: 1" = 32'-0"

NOTE:
U. S. Volleyball Association dimensions for unofficial games.
Court may be varied to suit players.

Figure 24. Volleyball.

league play is increasing, however, in urban areas. A bituminous surface is considered to be the most functional and economical for outdoor courts. Loam surfaces will not withstand the heavy play under the basket and are unusable for long periods in wet weather.

Dimensions vary with the age level: elementary, 60 by 40 feet; junior and senior high, 84 by 50 feet; and college, 94 by 50 feet. For the younger age group, eight-foot-high goals are suggested. Official rules specify goals 10 feet high. Courts should be oriented so that play is in a north-and-south direction.

Night lighting is desirable. Lines should be permanently painted or taped in a color contrasting to the surface. A one-eighth-inch drainage slope from side to side is recommended. Batteries of two or more courts are usually essential, with provision for auxiliary or practice backboards and baskets on the sides. Maximum safety can be attained by using single-pole backboards with four feet or more offset. Posts should be located outside of boundary lines. A 10-foot zone of unobstructed space outside the side and end lines is recommended. (See Figure 26.)

Tetherball

Tetherball is an individual or dual game using a ball and paddles or an inflated ball. It is played separately or coeducationally. The game is played as a class, intramural, and recreational activity.

The court contains a 10-foot upright wooden pole 7.5 inches in circumference at the ground and tapering to the top. A two-inch black line is painted on it six feet from the ground. A cord with a covered tennis ball or inflated ball attached hangs from the top of the pole to 2.5 feet from

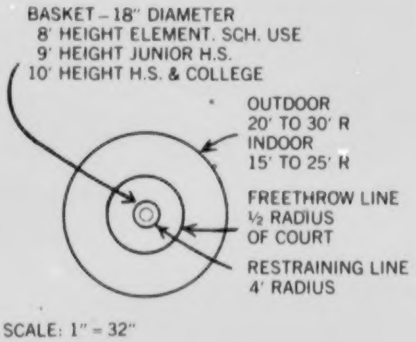
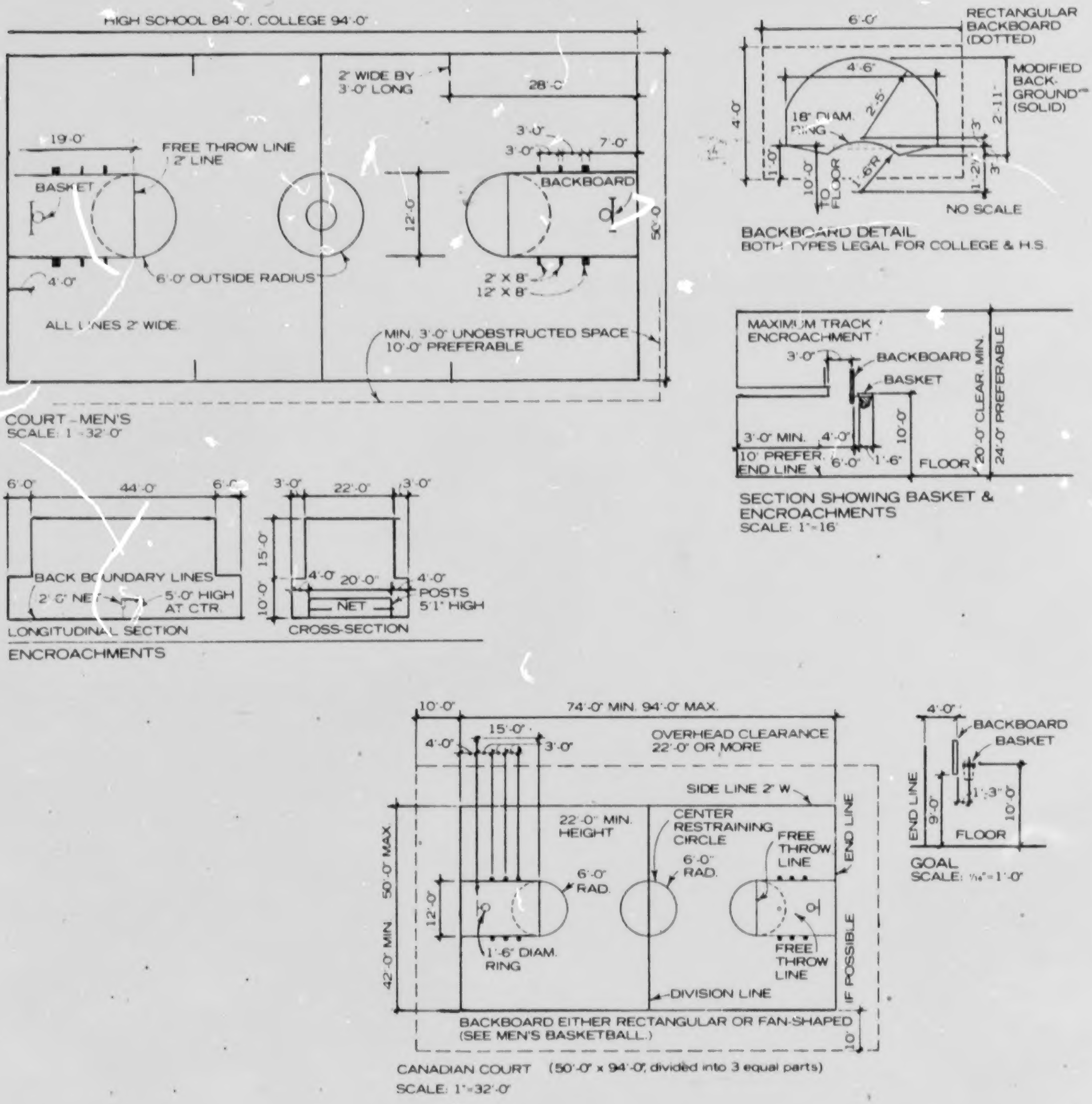

BASKET – 18" DIAMETER
8' HEIGHT ELEMENT. SCH. USE
9' HEIGHT JUNIOR H.S.
10' HEIGHT H.S. & COLLEGE
OUTDOOR 20' TO 30' R
INDOOR 15' TO 25' R
FREETHROW LINE ½ RADIUS OF COURT
RESTRAINING LINE 4' RADIUS
SCALE: 1" = 32"

Figure 25. Goal Hi.


HIGH SCHOOL 84'-0", COLLEGE 94'-0"
2" WIDE BY 3'-0" LONG
28'-0"
19'-0"
FREE THROW LINE 2" LINE
3'-0"
3'-0"
7'-0"
BASKET
BACKBOARD
12'-0"
50'-0"
4'-0"
6'-0" OUTSIDE RADIUS
2" X 8"
12" X 8"
ALL LINES 2" WIDE.
MIN. 3'-0" UNOBSTRUCTED SPACE 10'-0" PREFERABLE
6'-0"
RECTANGULAR BACKBOARD (DOTTED)
4'-6"
MODIFIED BACKGROUND (SOLID)
4'-0"
18" DIAM. RING
2'-5"
2'-11"
3"
1'-0"
10'-0" TO FLOOR
1'-6"R
1'-2"
3"
NO SCALE
MAXIMUM TRACK ENCROACHMENT
3'-0"
BACKBOARD
BASKET
3'-0" MIN.
4'-0"
10' PREFER.
END LINE
6'-0"
1'-6"
10'-0"
FLOOR
20'-0" CLEAR MIN.
24'-0" PREFERABLE
6'-0"
44'-0"
6'-0"
BACK BOUNDARY LINES
2'-0" NET
5'-0" HIGH AT CTR.
3'-0"
22'-0"
3'-0"
15'-0"
10'-0"
4'-0"
20'-0"
4'-0"
NET
POSTS 5'1" HIGH
10'-0"
74'-0" MIN. 94'-0" MAX.
15'-0"
4'-0"
3'-0"
OVERHEAD CLEARANCE 22'-0" OR MORE
SIDE LINE 2" W.
22'-0" MIN. HEIGHT
CENTER RESTRAINING CIRCLE
6'-0" RAD.
FREE THROW LINE
END LINE
42'-0" MIN. 50'-0" MAX
12'-0"
6'-0" RAD.
1'-6" DIAM. RING
FREE THROW LINE
IF POSSIBLE
DIVISION LINE
BACKBOARD EITHER RECTANGULAR OR FAN-SHAPED (SEE MEN'S BASKETBALL.)
10'
4'-0"
BACKBOARD
BASKET
END LINE
9'-0"
1'-3"
10'-0"
FLOOR

COURT – MEN'S
SCALE: 1" = 32'-0"

BACKBOARD DETAIL
BOTH TYPES LEGAL FOR COLLEGE & H.S.

SECTION SHOWING BASKET & ENCROACHMENTS
SCALE: 1" = 16'

LONGITUDINAL SECTION

CROSS-SECTION

ENCROACHMENTS

CANADIAN COURT (50'-0" x 94'-0", divided into 3 equal parts)
SCALE: 1" = 32'-0"

GOAL
SCALE: 1/16" = 1'-0"

Figure 26. Basketball.

the ground (two feet for inflated ball). The pole is placed in the center of an area approximately 25 feet in diameter.

There is no particular orientation of the court. The space should, however, be provided adjacent to other court facilities. The court should be of concrete or macadam pitched at least one-eighth inch per foot for adequate drainage. The play lines should be painted or taped on the surfacing. The court should be shrubbed or fenced to provide maximum safety and control.

Dodgeball

Dodgeball is a team game in which one team stands inside a circle formed by the other team. The team forming the circle throws the ball at the members of the other team, who try to avoid being hit. A court can be lined off on any reasonably flat surface (see Figure 27).

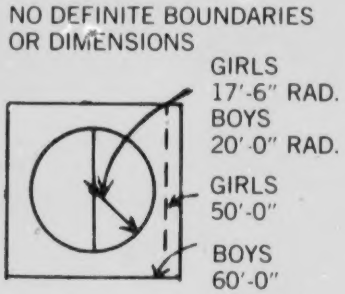


Figure 27. Dodge Ball.

Handball

ONE-WALL HANDBALL

One-wall handball is a fast physical activity played with a hard rubber ball stroked against the wall with the palm of the player's hand. It may be played by two or four players on a smooth concrete or bituminous surface with a wall 20 feet high.

Courts may be constructed so as to allow for one court on each side of the wall. At least six feet of clear space should be provided beyond the side and end lines. All lines are 1.5 inches wide. The courts may be erected near or between batteries of tennis courts to permit tennis players to use the walls as batter boards.

Courts should be pitched away from the wall with a grade of one-eighth inch per foot. The wall is 8 to 12 inches thick and is generally constructed of reinforced concrete. (See Figure 28.)

Additional rules and diagrams may be obtained from the U.S. Handball Association, 4101 Dempster St., Skokie, Ill.

TEAM OR EUROPEAN HANDBALL

European handball was introduced to the United States at the 1972 summer Olympics. Internationally, outdoor handball is disappearing while indoor handball is rapidly gaining in popularity.

Team handball is played by two teams, each consisting of 12 players (10 court players and two goalkeepers), of whom not more than seven (six court players and one goalkeeper) play at a time. The remaining players are substitutes.

Because team handball is a European sport, regulations for court layout and markings are given in metric measurements. The playing area is divided into two goal areas, the whole forming a rectangle 38 to 44 meters by 18 to 22 meters (40 by 20 meters is official playing-area measurement). The goals are two upright posts, three meters apart and two meters high, joined by a horizontal crossbar. Attached to the goal is a net that prevents an immediate rebound of a ball thrown into it. (See Figure 29.) See Part Two, Chapter 2 for building specifications.

Additional rules and diagrams may be obtained from the U.S. Team Handball Federation, 10 Nottingham Rd., Short Hills, N.J. 07078.

RACKET COURTS

Aerial Darts or Aerial Tennis

This is a net game involving two or more players who use a shuttlecock and rackets and who follow rules similar to those for volleyball. All individuals may participate in this sport in an organized class, in intramurals, or in a recreational program.

Courts should be 20 by 50 feet for singles and 26 by 50 feet for doubles. The lining is similar to that for tennis courts, except that the serving line is 40 feet from the end line. Courts should be oriented so that play is in a north-and-south direction.

The surface is the same as for tennis or badminton courts. A multipurpose area may be utilized. On such an area, however, lines should be of an identifiable color for the activity.

Deck Tennis

This activity originated on ships. It is played with a soft rubber ring or quoit six inches in diameter. The net posts are two feet outside the side line. The net is 1.5 feet wide and its top is five feet from the grade at all points. There are lines that mark the court boundary and also connect the side lines three feet from and parallel to the net, as illustrated (see Figure 30).

Badminton

Badminton is an individual and dual sport utilizing a shuttlecock and rackets. The activity may be included in programs for class instruction and intramural and recreational competitions. It is an excellent coeducational activity. Night lighting affords longer use of the courts.

The court dimensions are 44 by 20 feet for doubles and 44 by 17 feet for singles.

Posts should be set five feet, one inch high in the center of the sidelines. The net should be five feet high at the center. The orientation should be so that play is in a north-and-south direction. A multipurpose space may be utilized for the courts. In such instances, the courts should be in batteries of two or more, with 1.5-inch painted or taped lines superimposed on other appropriate areas. All measurements are to the outside of lines. It is recommended that additional space of four or five feet for the sidelines and eight feet for the ends be provided. (See Figure 31.)

Entrances and exits should be accessible at each end of the court. Fencing should enclose all courts in places accessible to the public.

The surface of the outdoor court should be bituminous or concrete material, although loam or turf is satisfactory. The slope of one-eighth inch to one foot maximum pitch from side to side will permit quick drainage.

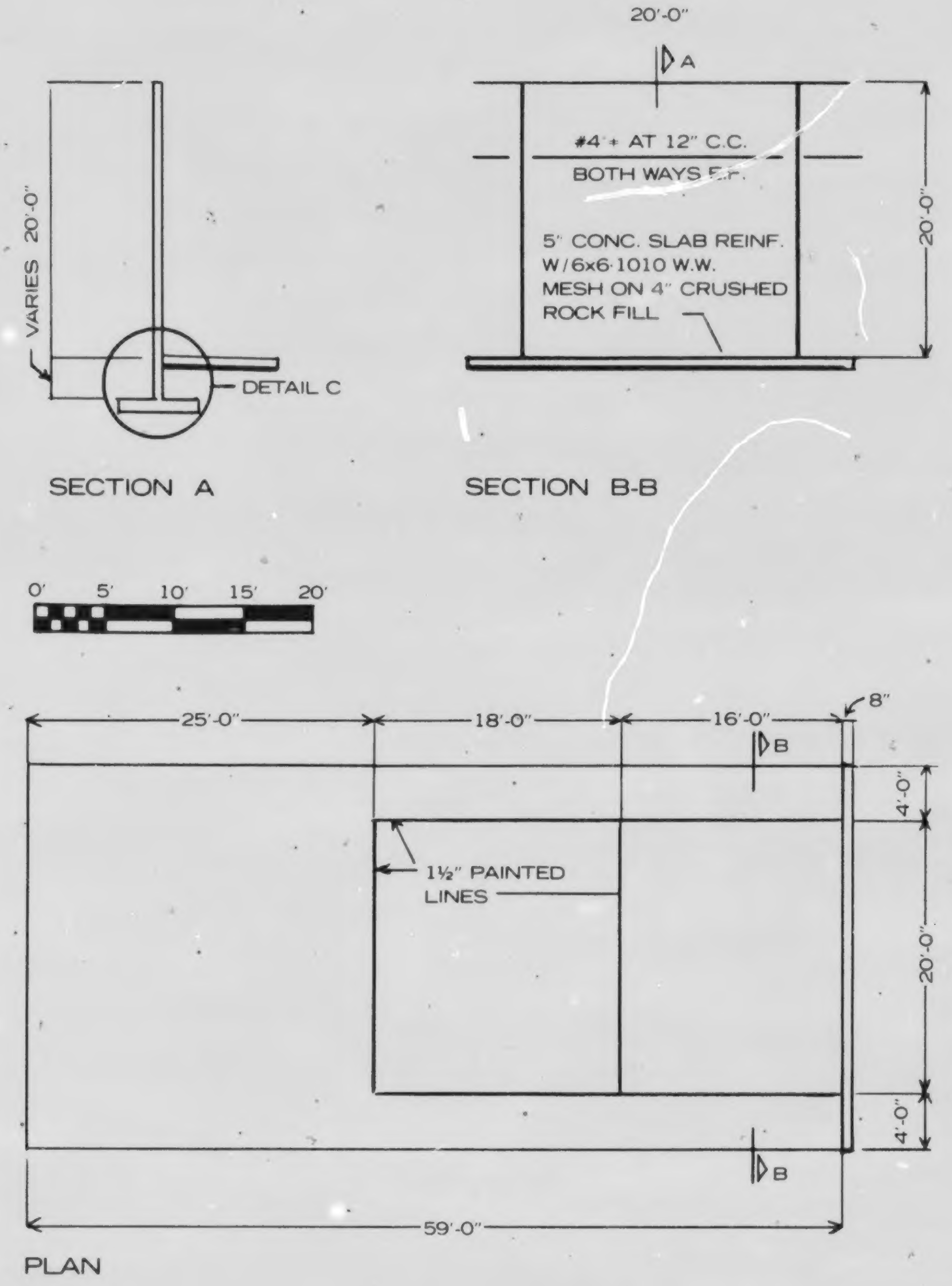

20'-0"
A
#4'+ AT 12" C.C.
BOTH WAYS E.F.
5" CONC. SLAB REINF.
W/6x6-1010 W.W.
MESH ON 4" CRUSHED
ROCK FILL
20'-0"
VARIES 20'-0"
DETAIL C
SECTION A
SECTION B-B
0'
5'
10'
15'
20'
25'-0"
18'-0"
16'-0"
8"
B
4'-0"
1½" PAINTED
LINES
20'-0"
4'-0"
B
59'-0"
PLAN

Figure 28. One-Wall Handball Court.

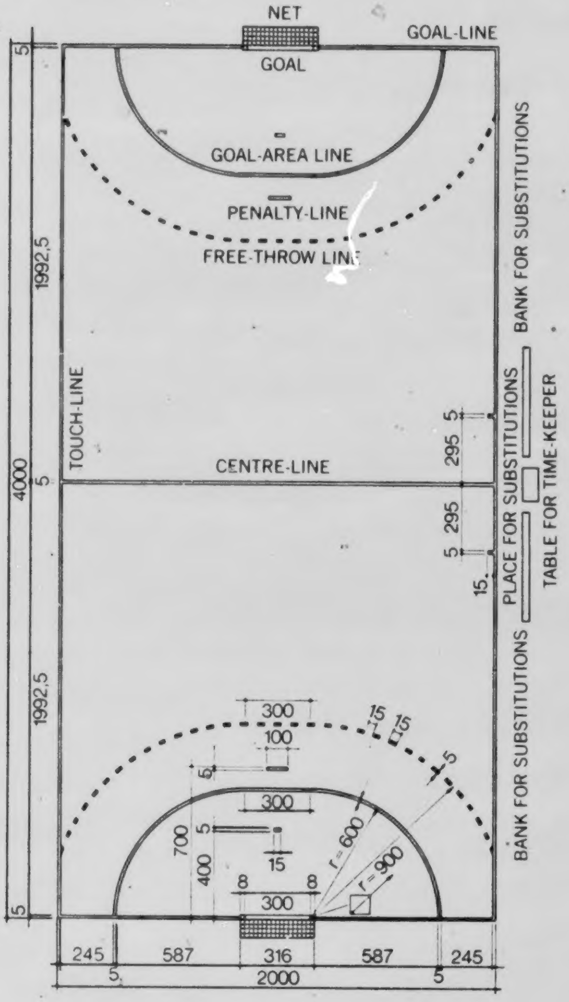

NET
GOAL-LINE
GOAL
GOAL-AREA LINE
PENALTY-LINE
FREE-THROW LINE
TOUCH-LINE
CENTRE-LINE
BANK FOR SUBSTITUTIONS
PLACE FOR SUBSTITUTIONS
TABLE FOR TIME-KEEPER
BANK FOR SUBSTITUTIONS
4000
1992,5
1992,5
5
5
5
295
295
5
5
15
300
100
6
300
700
400
5
15
8
8
300
15
15
5
r = 600
r = 900
245
587
316
587
245
5
2000
5

Figure 29. Team or European Handball.

Paddle Tennis

Paddle tennis is a fast-moving sport played by two or four players.

The rules and regulations are similar to those for tennis, except that the court is reduced to 44 by 20 feet (doubles) and 44 by 16 feet (singles). It is recommended that an additional six feet at the sides and eight feet at the ends be provided as buffer areas.

Officially, paddle tennis should be played on a wooden platform, but it is commonly played on a bituminous, concrete, or loam surface in neighborhood park-school or recreational facilities.

The net height is three feet, one inch at the posts and two feet, 10 inches at the center. Net posts may be the same as those used for badminton, volleyball, and deck tennis. (See Figure 32.)

Squash

Squash is a fast-moving indoor sport played as singles or doubles in a specially constructed court (see Figure 33). Refer to Part Two, Chapter 2, for additional construction suggestions.

Tennis

Tennis is a very popular sport among most age groups, and most communities either have tennis courts or are considering them for future construction.

SIZE

The minimum size of the area required for constructing a tennis court is 60 by 120 feet. A battery of tennis courts is more economical than an individual court. When a battery of courts is to be developed, a minimum distance of 10 feet and a maximum of 12 feet should be allowed between courts. A minimum of 12 feet and a maximum of 15 feet should be allowed from the sideline of a court, or battery of courts, to the edge of the court surface. A distance of 21 feet should be allowed from the base line to the rear of the court surface. When courts are enclosed by a fence, these distances should be allowed between the court lines and the fence. The court surface should then

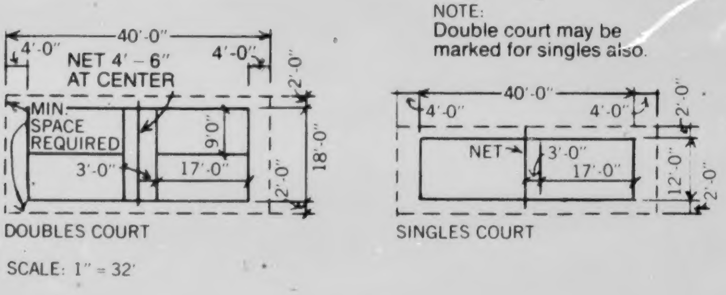

40'-0"
4'-0"
NET 4' - 6" AT CENTER
4'-0"
2'-0"
MIN. SPACE REQUIRED
9'-0"
18'-0"
3'-0"
17'-0"
2'-0"
DOUBLES COURT
SCALE: 1" = 32'
NOTE: Double court may be marked for singles also.
40'-0"
4'-0"
4'-0"
2'-0"
NET
3'-0"
17'-0"
12'-0"
2'-0"
SINGLES COURT

Figure 30. Deck Tennis.

be extended six inches beyond the fence to simplify maintenance. (See Figures 34 and 35.)

SITE SELECTION

Tennis courts should be located in a relatively flat area. They should also be in an area that provides protection from the prevailing breezes. When this is not possible, protection may have to be provided by the use of plant material, tarpaulins, nettings, or other types of wind screens.

Courts should be oriented so that play is in a north-and-south direction unless they are to be used strictly for night play.

DRAINAGE

Surface and subsurface drainage are of prime importance in the construction of tennis courts. The various acceptable methods of surface drainage, in order of preference, are as follows:

- Sloping from side to side or diagonally.
- Sloping from one end (rear of court) to the other.
- Sloping from center line to rear of courts.
- Sloping from rear of courts to center (toward net).

Each of these drainage methods has its own advantages and disadvantages, but the main objective is to shed the water and still provide the players with a playable surface.

The percentage of slope of the courts is dependent upon the type of surfacing to be used. The ideal court is level, which can only be accomplished by building the court inside a building or by using such surfaces as crushed chips or lawn with excellent subsurface drainage. The following are recommended percentages of slope for the various types of tennis-court surfaces:

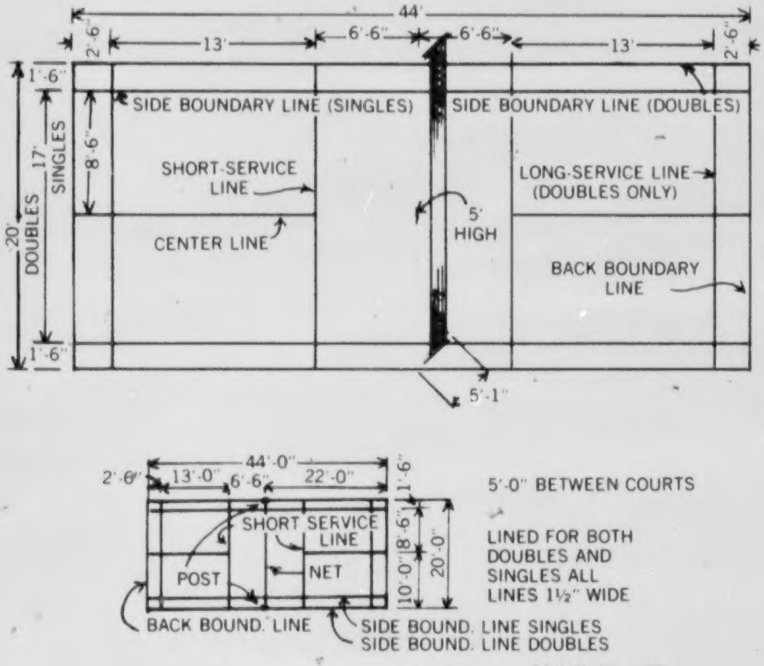

44'
2'-6"
13'
6'-6"
6'-6"
13'
2'-6"
1'-6"
17' SINGLES
8'-6"
20' DOUBLES
1'-6"
SIDE BOUNDARY LINE (SINGLES)
SIDE BOUNDARY LINE (DOUBLES)
SHORT-SERVICE LINE
LONG-SERVICE LINE (DOUBLES ONLY)
5' HIGH
CENTER LINE
BACK BOUNDARY LINE
5'-1"
44'-0"
2'-6"
13'-0"
6'-6"
22'-0"
1'-6"
SHORT SERVICE LINE
POST
NET
10'-0"
8'-6"
20'-0"
BACK BOUND. LINE
SIDE BOUND. LINE SINGLES
SIDE BOUND. LINE DOUBLES
5'-0" BETWEEN COURTS
LINED FOR BOTH DOUBLES AND SINGLES ALL LINES 1½" WIDE
SCALE: 1" = 32'

Figure 31. Badminton.

Type of Surface	Minimum Slope	Maximum Slope
Concrete	0.5%	1.0%
Bituminous (various types)	1.0%	1.5%
Clay	0.75%	1.0%
Crushed Materials	0.75%	1.0%
Lawn	0.75%	1.0%

SURFACING

There are two basic types of surfacing to be considered for tennis courts, porous and nonporous. Many different kinds of materials are available for each of these types of surfacing.

Porous surfacing includes clay, lawn, and crushed materials. No matter which of these surfaces is used, there is a constant maintenance problem throughout the season.

Nonporous surfacing includes concrete and the various bituminous combination surfaces. Although some of these may be more costly at the time of construction, most nonporous surfaces provide lower maintenance costs and can usually be colored if desired.

FENCING

The most common material used for the fencing of tennis courts is chain-link fabric. This fencing should have a minimum height of 12 feet along the rear lines of the courts and 10 feet on the sides.

If possible, the courts should be entirely enclosed by fencing. Where cost is a major factor, the fencing may be placed along the rear of the courts, with a 20-foot wing return on the sides. The fence fabric should be placed on the inside of the fence posts.

SPECIAL CONSTRUCTION FEATURES

The lighting of tennis courts is dependent upon the popularity of the activity within the geographic location.

Practice boards (batter boards) may be included in tennis courts for practice and instructional purposes when finances permit.

Should it be desirable to adapt tennis courts for multipurpose uses, consideration of the necessary construction changes should be made prior to court construction. Later revisions may be prohibitively high in cost.

MISCELLANEOUS COURTS

Dancing

This activity involves hopping, running, shuffling, stepping, or walking movements to music. It may be included in classes, intramurals, and recreational programs at all levels. It is an excellent social mixer.

A sealed, smooth, hard-surface area provides the most desirable surface for dancing. Paved multipurpose areas are most frequently used for this activity.

Fencing

Fencing is an individual sport in which the two opponents use foils, epees, or sabres. Contestants wear masks, jackets, and gloves.

A fencing bout takes place between two persons on a paved or turf strip or on a mat. The area used can be a multipurpose area. The activity may be included in class, intramural, and recreational programs.

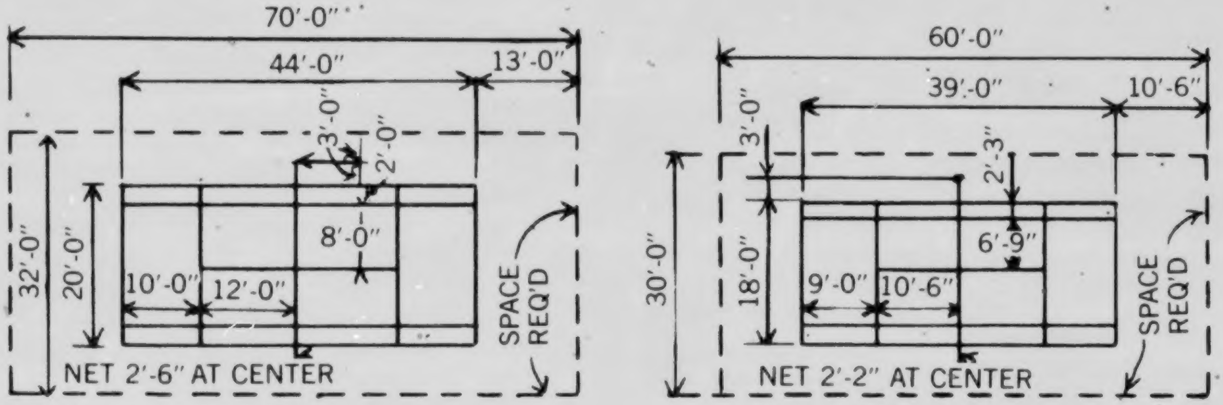
The court should be oriented so that play is in a north-and-south direction. It should be well-drained with a pitch no less than one-eighth inch per foot. The length of the court is 45 feet, 11 inches, plus end zones of 5 feet, 11 inches; the width is 5 feet, 10 inches, to 6 feet, 7 inches (see Figure 36). The court should have an adequate safety zone plus space for judges, timers, and other officials. There should also be a fence or hedge around the court to prevent accidents or horseplay.

Obstacle Running

The obstacle course contains a series of obstacles designed to test individual skill, strength, and agility. The course may be used by persons of both sexes, with from one to three persons participating.

Since turf would wear and cause excessive maintenance, the course is constructed with an adequately-drained surface of pavement, clay, or sand. The course should be contained in a fenced or buffered area to prevent horseplay and to provide control and safety. It should have two entrances or exits.

The course should include fences, a tunnel, parallel bars, balance beams, and wood, brick, or concrete panel walls. The total course should be located in or adjacent to the apparatus area.



SENIOR COURT (OFFICIAL PLAY)

JUNIOR COURT

SCALE: 1" = 32'

Figure 32. Paddle Tennis.

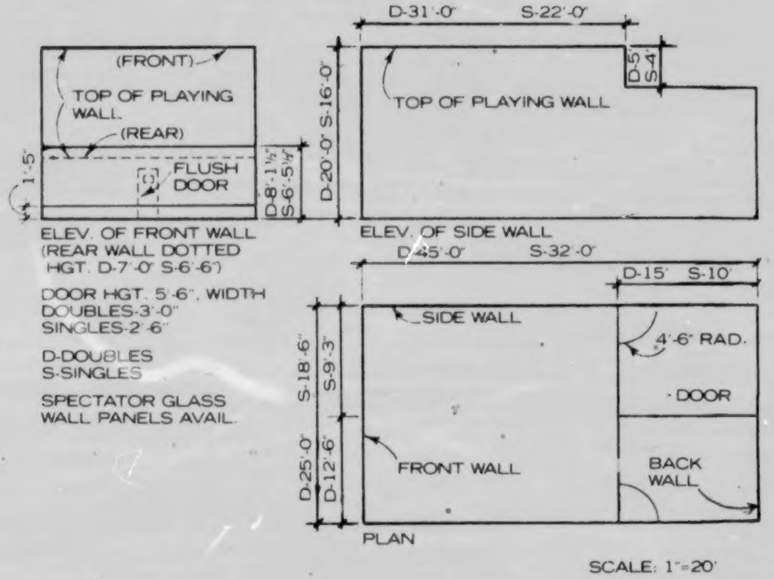

(FRONT)
TOP OF PLAYING WALL
(REAR)
1'-5"
FLUSH DOOR
D-8'-1½"
S-6'-5½"
D-20'-0" S-16'-0"
ELEV. OF FRONT WALL
(REAR WALL DOTTED
HGT. D-7'-0" S-6'-6")
DOOR HGT. 5'-6", WIDTH
DOUBLES-3'-0"
SINGLES-2'-6"
D-DOUBLES
S-SINGLES
SPECTATOR GLASS
WALL PANELS AVAIL.
D-31'-0" S-22'-0"
D-5' S-4'
TOP OF PLAYING WALL
ELEV. OF SIDE WALL
D-45'-0" S-32'-0"
D-15' S-10'
SIDE WALL
4'-6" RAD.
DOOR
S-18'-6" S-9'-3"
D-25'-0" D-12'-6"
FRONT WALL
BACK WALL
PLAN
SCALE: 1"=20'

Figure 33. Squash.

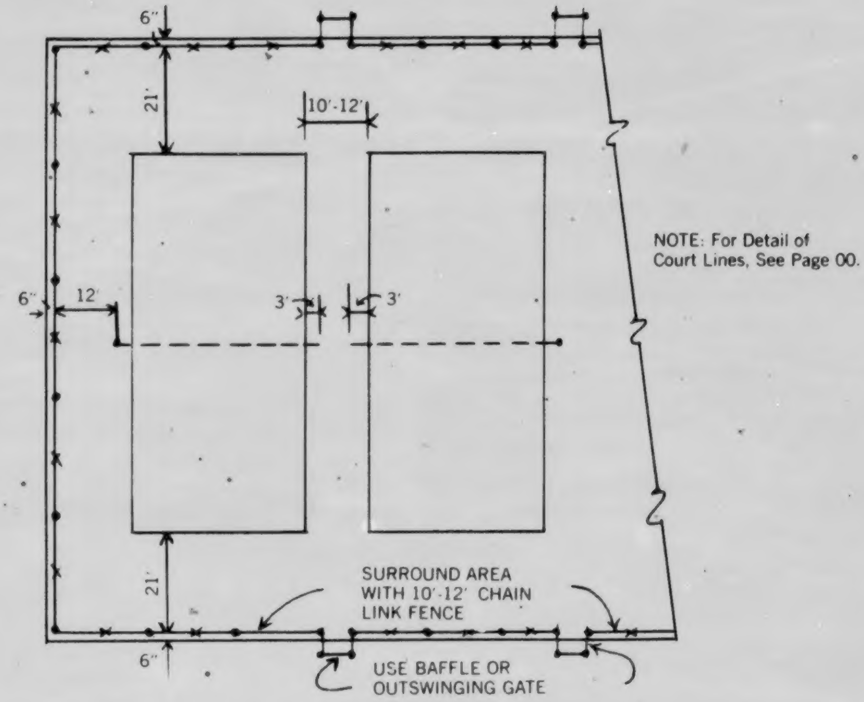
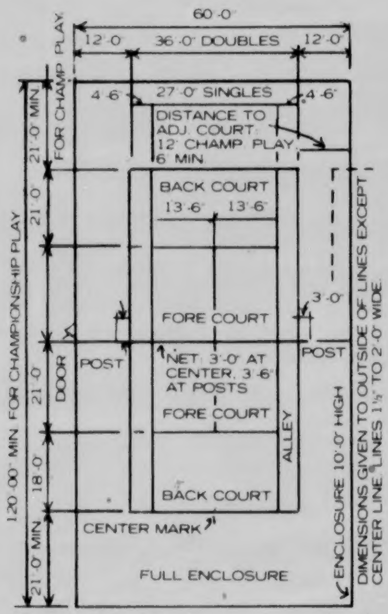
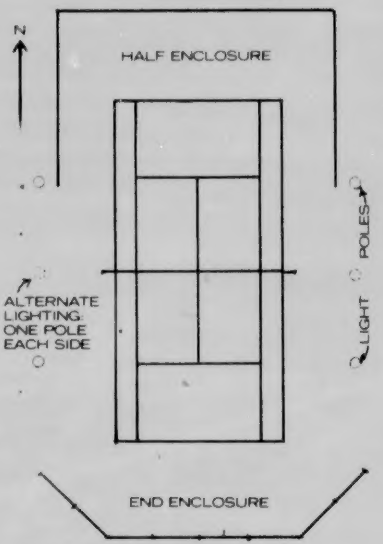

6"
21'
10'-12'
6"
12'
3'
3'
NOTE: For Detail of Court Lines, See Page 00.
21'
SURROUND AREA WITH 10'-12' CHAIN LINK FENCE
6"
USE BAFFLE OR OUTSWINGING GATE

Figure 34. Design for Battery of Tennis Courts.

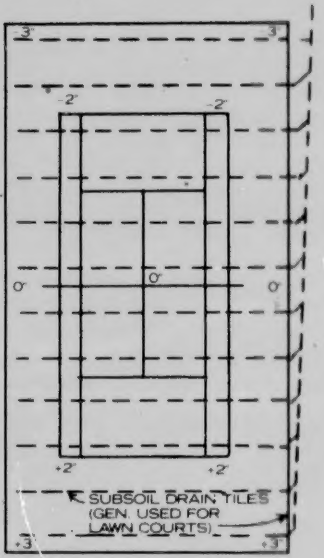

60'-0"
12'-0"
36'-0" DOUBLES
12'-0"
27'-0" SINGLES
4'-6"
4'-6"
DISTANCE TO ADJ. COURT 12' CHAMP. PLAY, 6' MIN.
BACK COURT
13'-6"
13'-6"
FORE COURT
3'-0"
POST
POST
NET: 3'-0" AT CENTER, 3'-6" AT POSTS
FORE COURT
BACK COURT
ALLEY
DOOR
CENTER MARK
FULL ENCLOSURE
21'-0" MIN FOR CHAMP. PLAY
21'-0"
21'-0"
18'-0"
21'-0" MIN
120'-00" MIN FOR CHAMPIONSHIP PLAY
ENCLOSURE 10'-0" HIGH
DIMENSIONS GIVEN TO OUTSIDE OF LINES EXCEPT CENTER LINE. LINES 1½" TO 2'-0" WIDE.

STANDARD COURT
SCALE: 1"=32'-0"

ORIENTATION:
For the Northern states, North-Northeast and South-Southeast is best

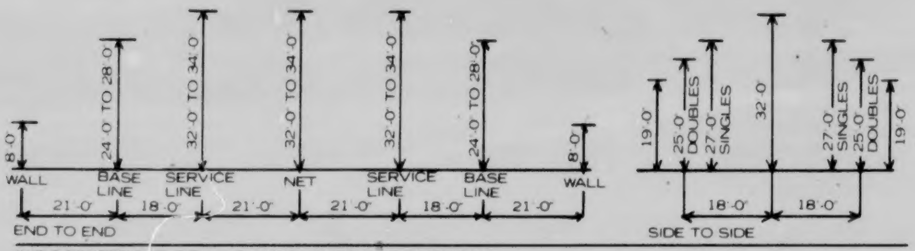

N
HALF ENCLOSURE
ALTERNATE LIGHTING: ONE POLE EACH SIDE
LIGHT POLES
END ENCLOSURE

PARTIAL ENCLOSURES
SCALE: 1"=32'-0"

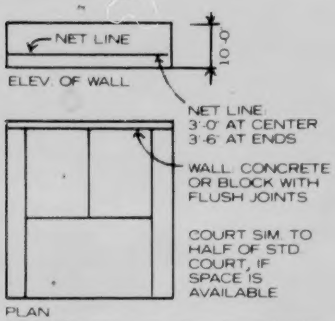

-3"
-3"
-2"
-2"
0"
0"
0"
+2"
+2"
+3"
+3"
SUBSOIL DRAIN TILES (GEN. USED FOR LAWN COURTS)

DRAINAGE PLAN (2 OR MORE COURTS)
SCALE: 1"=32'-0"

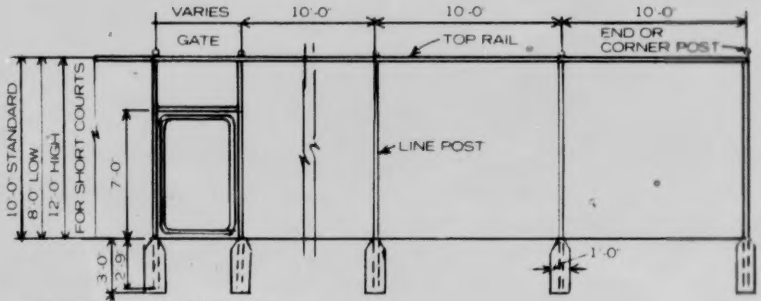
NOTE:
Surface drainage-Pitch ½" per 10'-0". Pitch side to side for single court: pitch end to end for 2 or more courts. Need for drainage system depends on soil conditions.


8'-0"
24'-0" TO 28'-0"
32'-0" TO 34'-0"
32'-0" TO 34'-0"
32'-0" TO 34'-0"
24'-0" TO 28'-0"
8'-0"
WALL
BASE LINE
SERVICE LINE
NET
SERVICE LINE
BASE LINE
WALL
21'-0"
18'-0"
21'-0"
21'-0"
18'-0"
21'-0"
END TO END
19'-0"
25'-0" DOUBLES
27'-0" SINGLES
32'-0"
27'-0" SINGLES
25'-0" DOUBLES
19'-0"
18'-0"
18'-0"
SIDE TO SIDE

INDOOR TENNIS CEILING HEIGHT REQUIREMENTS


NET LINE
10'-0"
ELEV. OF WALL
NET LINE: 3'-0" AT CENTER 3'-6" AT ENDS
WALL: CONCRETE OR BLOCK WITH FLUSH JOINTS
COURT SIM. TO HALF OF STD. COURT, IF SPACE IS AVAILABLE
PLAN

PRACTICE COURT
SCALE: 1"=32'-0"

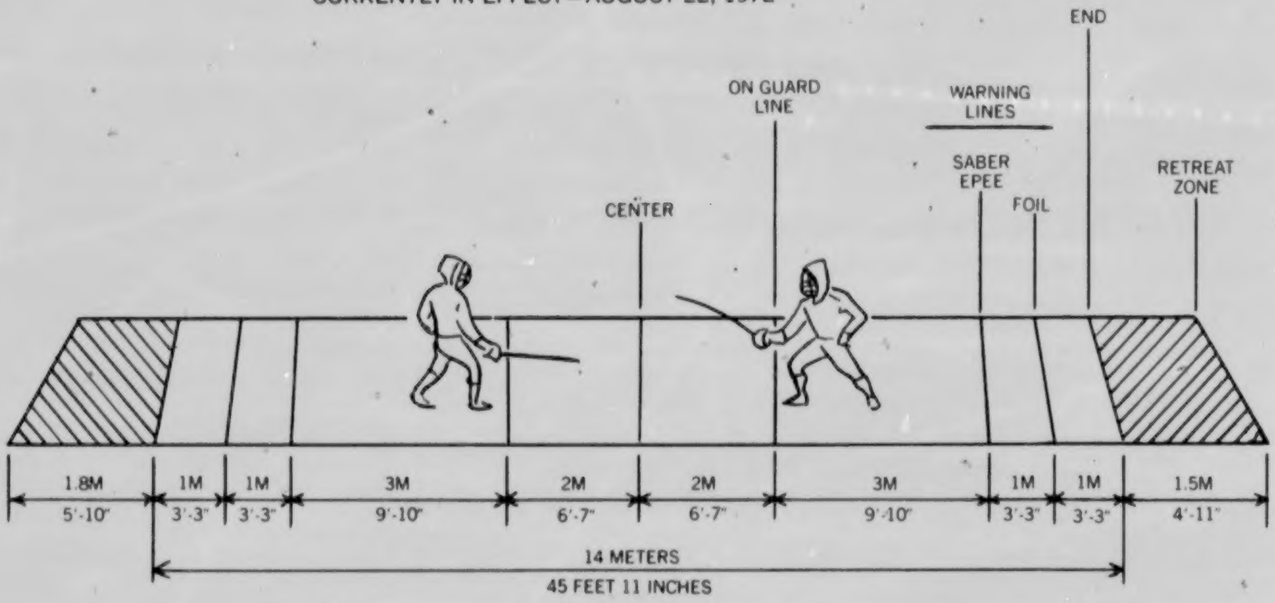

VARIES
10'-0"
10'-0"
10'-0"
GATE
TOP RAIL
END OR CORNER POST
10'-0" STANDARD
8'-0" LOW
12'-0" HIGH FOR SHORT COURTS
7'-0"
LINE POST
3'-0"
2'-9"
1'-0"

ELEVATION OF ENCLOSURE
SCALE: 1"=8'-0"

Charles F. D. Egbert, AIA, Architect: Washington, D.C.

Figure 35. Specifications for Tennis Courts.

THE REGULATION F.I.E. AND A.F.L.A. FENCING STRIP
CURRENTLY IN EFFECT—AUGUST 22, 1972


END
ON GUARD LINE
WARNING LINES
SABER EPEE
FOIL
RETREAT ZONE
CENTER
1.8M
5'-10"
1M
3'-3"
1M
3'-3"
3M
9'-10"
2M
6'-7"
2M
6'-7"
3M
9'-10"
1M
3'-3"
1M
3'-3"
1.5M
4'-11"
14 METERS
45 FEET 11 INCHES

NOTE: The width of the strip shall be a minimum of 1.8 meters (5'-10") and a maximum of 2 meters (6'-7"). The length of the retreat zone shall be a minimum of 1.5 meters (4'-11") and a maximum of 2 meters (6'-7"). For Foil and Epee, the metallic surface of the strip shall cover the entire retreat zone.

Figure 36. Fencing.

Chapter 2

FIELD HOUSES and STADIUMS

Man has responded to the needs of sporting events and the interests of spectators and participants by building structures using the raw materials and engineering skills of the time. The Greeks have left such famous examples as the marble ruins of the Olympia Stadium and the Gymnasium in the Agora at the foot of the Acropolis. The influence and engineering genius of the Romans is marked by the stone and marble coliseums that still stand. Since 1896, sites for the modern Olympic Games have become larger, more sophisticated, and more complex with each Olympiad. Schools have built brick and concrete field houses and stadiums taking advantage of the latest scientific knowledge, so that each structure outdoes the previous one.

Today, the trend is toward the multipurpose center, which serves wider needs than just those of the educational institution's athletic and physical education programs. New synthetic materials, new building techniques, and—most important—new program needs appear continually, making the task of building a permanent, single-use edifice nearly impossible and surely unwise.

Field houses were first constructed in the United States to meet storage needs near outdoor sports fields. It was a natural step to move practice periods for outdoor sports under the roof and on the bare ground of the field house in inclement weather or early in the season. Designers began to include lockers and showers in the field house. Today, they are elaborate structures with floors and spectator accommodations, providing wider indoor recreational and instructional usage.

The stadium is built for exhibition purposes and geared to spectator interests with mass seating. In addition to competitive athletic events, these structures are often used for such purposes as convocations, concerts, mass meetings, and rallies. If located near educational facilities, they are also used for instructional purposes.

The 1970's bring not only new scientific discoveries, but also new educational philosophies. Many factors, including economics, program needs, technology, and community recreational desires, make the multipurpose facility paramount in modern construction plans.

PLANNING

To ensure that when the facility is constructed it will meet the intended needs of users, whether students, faculty, citizens, or professionals, a detailed study must be made prior to the drawing of architectural plans. This study should include a survey of existing facilities and resources; present and projected physical education, athletic, club, and recreational programs; maintenance requirements; tournament and mass meeting needs; and terrain desired. Ultimately, architectural design should take into account the survey findings as well as general terrain, regional building styles, practicality, latest scientific materials, and aesthetic values. A well-planned facility, for which attention has been given to specific program needs and a detailed analysis has been conducted, will enhance the community as well as the educational institution of which it is a part.

The plans and specifications must be checked by all governmental agencies (city, county, and state) whose approval is required by law. Plans for areas and facilities need to conform both to state and local regulations and to accepted standards and practices.

Experience indicates that a well-formulated guideline in the form of a check list is of inestimable value to the facility planner. Following is a list that covers the major considerations for both field house and stadium:

- Provide ample space for the activities desired.
- Include adequate administrative, recreational, and service facilities.
- Design for future needs.
- Provide accommodations for men and women.
- Provide drainage around the exterior of the building.
- Provide adequate storage space.
- Install proper lighting.
- Provide for maintenance of light fixtures.
- Provide adequate wiring, with provision for high-voltage current.
- Provide windows and skylights with minimum glare intensity.
- Install sufficient and well-placed heating vents.
- Provide for sufficient natural ventilation.
- Include adequate exhaust fans and vents.
- Provide well-placed ticket-sale and ticket-taking facilities.
- Provide for telephone, television, radio, and telegraph facilities in the press area.
- Provide an adequate sound system.
- Provide an entrance large enough for the delivery of equipment.
- Provide waterproof insulation for the ceiling.
- Place pipelines an adequate distance from the floor.
- Provide sufficient shower and locker facilities.
- Install an adequate public-address system.
- Include adequate facilities for cleaning and maintenance.
- Include sufficient water outlets.
- Provide for expansion or change.
- Provide for portable facilities.
- Plan for accommodation of spectators in areas where needed.
- Provide well-designed spectator exits.
- Include an adequate lobby and vestibule.

- Provide a sufficient number of electrical outlets, and place them for easy access.
- Select good paint colors for the interior of the building.
- Place windows away from goals and goal lines.
- Provide filters in the air-circulation system.
- Include movable and folding partitions, power-operated and controlled by keyed switches.
- Include wall plates located where needed and firmly attached.
- Include hooks and rings for nets placed (and recessed in walls) according to court locations and net heights.

LOCATION

Of prime importance to the usage of the new facility is the decision as to its location. Such a decision must take into consideration accessibility, drainage, aesthetics, landscape and topography, property lines and easements, utilities, ecological and biological conditions, parking, and security.

The facility should be accessible to those who use it most frequently. Therefore, it should be located near the major classroom buildings, dormitories, and physical education buildings. The facilities open to spectators should be easily accessible to the public with a minimum of traveling through other areas. An analysis of the anticipated traffic flow in the building will pay enormous dividends in terms of easier supervision and lower maintenance costs.

Facilities should be so located as to permit expansion. Attention should also be given to the slope of the land outside the buildings to prevent surface drainage. Engineering features for foundations, reinforcement, drainage, pumps, and valves should be determined in the light of the qualities of the land area.

The facility should be located in attractive surroundings and should be pleasing in design. The design should be functional rather than traditional. It is possible for an architect to plan a building that will be modern and functional but still blend in with the other architecture of the area. An effort should be made to locate the structure away from industrial and congested areas.

Adequate parking areas adjacent to the facility, with a paved access roadway leading to the building, are necessary.

Where admission is charged, a fence with a minimum height of seven feet surrounding the spectator structure and the enclosed field is essential. Gates are necessary for spectator and service entrances and exits. Admission gates should be located near the parking lots and other main approaches to the structure. The number and size of the entrances depends on predicted and future attendance. Exits should permit the crowd to vacate the enclosure in 10 minutes or less. Twenty-two inches of linear exit space should be permitted for each 500 spectators. At least one gate 14 feet high and 14 feet wide should be provided to accommodate trucks and buses.

FIELD HOUSE

The field house provides enclosed and unobstructed space adaptable to indoor and outdoor sports activities. It is not a substitute for the gymnasium; it is, rather, complementary and supplementary to other facilities.

Typical educational functions include instruction in the physical education program; practice for intercollegiate athletics (football, track and field, baseball, basketball, tennis, soccer, lacrosse, and other sports); intramural, interscholastic, and intercollegiate competition; informal play; horseback riding; demonstrations and exhibitions that attract large crowds of spectators; commencement exercises; registration; and final examinations. Community uses may include concerts, exhibits, and mass meetings.

Educational institutions should consider their total physical education program when planning a field house. It may be desirable to include facilities for co-physical education and co-recreation, such as tennis, volleyball, badminton, and golf. Unless provided in the gymnasium, handball and squash courts should be constructed in the field house.

Location and Size

Some institutions may wish to plan a field house in connection with a stadium or arena. In this case, consideration should be given to combining the two structures in such a manner that the back wall of the stadium may serve as one of the sidewalls of the field house. Such a plan may have interesting possibilities, both from the standpoint of economy and with respect to a more effective development of the areas under the stadium.

If the field house is needed for class instruction on a campus, the preferable location is adjacent to the main gymnasium building and natatorium. If space is not available in proximity to the gymnasium, the field house will serve well for intramural activities and intercollegiate sports, even though it is constructed in a peripheral area of the campus. It should, however, be placed in an area contiguous to athletic fields and where parking problems are not critical.

The size of the field house should be determined by careful study of the present and future needs of programs in athletics, physical education, and recreation; climatic conditions of the area; existing facilities; and available funds. Consideration should be given to the size and number of groups (classes, squads, teams) likely to use the facility simultaneously. There should be a minimum of interference among the groups.

The minimum length of the field house should accommodate at least a 60-meter straightaway for men's track, plus sufficient distance for starting and stopping. A wide door at the end of the straightaway, to permit competitors to run outside the field house, will prevent injuries and eliminate a psychological hazard where space is limited. Six lanes are desirable. Some provision should be made for the elimination of entrances so as to protect individuals who may enter the field house at track level and collide with runners on the track. The track should be of such size as to be a convenient fraction of a longer standard distance.

The area surrounded by a one-eighth-mile track can include the following facilities: a regulation basketball court; a tennis court on each side of the basketball court; broad-jump, high-jump, and pole-vault runways and pits; and a shot-put area. It is preferable to isolate the shot-put area at one end of the building. Portable pit boxes can be brought within the track oval for shot-put, high-jumping, and pole-vaulting during meets attracting numerous spectators. The minimum width required to house a baseball infield is 125 feet. A one-eighth-mile track enclosing baseball facilities requires an area at least 200 meters long and 160 feet wide.

Thus, the size of the facility depends in large part on the kinds of activities it will house. It depends also on the numbers of persons participating. Dimensions of the activity area should not be less than 150 by 250 feet. The practical number of square feet per person is determined on a sliding scale. A college of 1,000 students requires 18 to 20 square feet per student, while for a larger institution the figure decreases to 12 to 15 square feet per student.

The height of the structure will be determined by the number and location of balconies to be provided. The field house must be able to accommodate crowds effectively and safely, particularly when many different types of activities are scheduled.

Roofs

Traditional roofs constructed of wood and/or steel have, since about 1961, been joined by a newly accepted type of roofing—air structures. For many institutions, the "bubble" is the answer to an increasing need for large activity areas at a relatively nominal cost. There are a number of kinds of air structures now on the market. Some of these are the following:

Description	Area (Sq. Ft.)
Air-Supported Structure, 5-year life dismantled and stored in summer	15,000
Air-Supported Structure, 5-year life air-conditioned in summer	15,000
Air-Supported Structure, 7-year life dismantled and stored in summer	15,000
Air-Supported Structure, 7-year life air-conditioned in summer	15,000
Frameless Corrugated Steel Arch, uninsulated (Wonder Building)	15,000
Frameless Corrugated Steel Arch, insulated (Wonder Building)	15,000
Frameless Corrugated Steel Arch, insulated, with skylights (Wonder Building)	15,000
Rigid Frame Metal Building, insulated (Butler)	11,100
Plywood Building with folded plate roof, insulated	11,000
Geodesic Dome Structure (Charter Industries) aluminum frame, suspended fabric	10,200
Trussed Steel Arch Building, sheet steel covering, insulated (Butler "Triodetic")	30,000
Steel Rigid Frame, metal roof, insulated; * lightweight concrete block walls (Varco-Pruden)	37,330
Cable-reinforced air-supported structure	
Wood Arched (hyperbolic paraboid)	
Umbrella Portable Type (planned for '76 Olympics at Montreal)	

Illustrations of some of these kinds of structures appear in Part Two, Chapter 8.

Floors

The floor of the field house should be resistant to weather and heavy usage. Dirt floors are not recommended. Rubber asphalt and several patented rubber-like synthetics should be considered.

Wood is not obsolete. It is now returning in popularity, because there are new surfaces that reduce glare and offer flexibility. One solution is to cover the wood with urethane. A uniform one-eighth-inch finish of urethane will last for 20 years. Such flooring provides the resilience of wood without the splinters. If wood is not used, planners should consider a portable wood floor for basketball.

Lighting, Heating, and Ventilation

Windows should be equipped with means to prevent the interference of sunlight with player performance at any time during the day. Walls and ceilings should be light in color. Catwalks are necessary for servicing the ceiling lights, spotlights, and net. (For lighting specifications, see Part Two, Chapter 7.)

Condensation problems should be given major consideration, particularly where there are extremes of temperature, where sprinkling of surface or dirt areas is required, and where large crowds witness events in the field house. To promote reabsorption of excess condensation, the building should be heated by the circulation of warm air in addition to fixed radiation. Adequate means should be provided to supply fresh air and exhaust foul air. The walls inside and outside should be impervious to vapor pressure. Technical heating, ventilating, and lighting problems should be referred to a specialist. In consideration of the typical shape of field houses, which includes a tunnel vault roof, there should be no parapets.

Bleachers and Balconies

Permanent seating facilities may be provided in a balcony and on the level of the playing floor. Because permanent seats restrict the use of a basketball pavilion, they should not be used at the level of the playing floor in such a facility.

The height of the last row of seats is determined by the number of rows and the increased elevation of each. The height of the seating surface of the first row should be 22 inches from the floor, and each successive row should be 8.5 to 11.5 inches higher than the preceding one.

The width of each seating space should not be less than 18 inches, and 21 inches is recommended. The required space per person will vary from 2.7 to 3 square feet. Sight lines should be considered in relation to the increase in elevation between successive rows. It is preferred that spectators have focal points of vision at the court boundary line nearest the seats. Focal points more than three feet above these boundary lines are unsatisfactory.

When bleachers are extended, the first row should be at least 10 feet away from the court sidelines and end lines. The depth of closed bleachers varies from three feet for 10 rows to 1.5 to 7.5 feet for 23 rows.

The elevated seating deck or platform can be used to supplement the number of seats provided at floor level. Removable bleachers for the deck should be the same as those used at floor level. By adopting this design, planners provide additional activity space on the deck and in the area under it. The depth of the deck depends upon the number of bleacher rows. Temporary bleachers should be thoroughly inspected before they are used, and their capacity should never be taxed.

Balconies may be constructed to provide seats to supplement removable bleachers at court level and on the elevated deck. They can be either a continuation of removable bleachers or elevated above them and extended partially over the seating at a lower level. Balcony seats may have backs or be similar to those for stadiums.

When permanent balconies are planned, they should be constructed without supporting pillars that would interfere in any way with the playing or visual area. They should be served by ramps connecting directly, or by means of wide corridors, with convenient entrances and exits. Ramps have a slope of at least one-foot rise in 12 feet. Minimum landings are five by five feet and extend at least one foot beyond the swinging arc of a door. The ramps should have at least a six-foot clearance at the bottom and level platforms at 30-foot intervals on every turn.

The field house should be so designed that the normal flow of traffic will not encroach upon the activity areas, in order to avoid interference with instruction and participation and to decrease maintenance costs. Permanent seating should be kept to a minimum in areas used primarily for instruction; roll-away bleachers are preferable.

In areas designed primarily for basketball, spectators should enter and exit at a single level at various points around the circumference, from an exterior perimeter walkway. Designers may decide on the use of a continuous cross aisle connected through the exit tunnel to the concourse. In such a design, all seats above this cross aisle are accessible only by means of stairs at each exit tunnel, while the lower seats can be reached from the vertical aisles connecting the main cross aisle. This system simplifies the flow of spectators to and from an event and allows for efficient management and control at one level. A portion of the lower seats are attached to telescopic platforms, which roll back into wall pockets when a larger arena floor is desired.

To determine requirements for ramps, stairs, exits, doors, corridors, and fire-alarm systems, planners should consult local and state laws and the recommendations of the National Fire Protection Association.

Additional Accommodations For Public Events

Scoreboard and timing devices should be of sufficient number and so placed as to be readily seen by players and all spectators. They should be easy to operate and readily accessible for maintenance purposes. Provision should be made for installation of a public-address system. Acoustic treatment of the building is desirable as well.

Accommodations for reporters, sports broadcasters, and scouts should be planned in the original design. Soundproof broadcasting and television booths should be provided for these services if the field house will be used for attractions of considerable public interest. At basketball games, however, the working press prefers to be as close to the action as possible, so space should be provided at courtside.

When the field house is designed to accommodate large crowds, concession booths should be constructed. They should be equipped with electric or gas stoves, sinks, running water, and sewer connections and should be located where they do not interfere with the normal flow of traffic. The booths should be accessible from all seats. Approximately 100 square feet per 1,000 spectators should be allowed for permanent concession booths.

Entrances and Exits

Entrances to the field house should be located with reference to parking facilities and traffic approaches. Provisions should be made for a paved access roadway, in addition to at least one entrance large enough to accommodate trucks. The main lobby should be of sufficient size to accommodate anticipated crowds seeking tickets and admission, particularly in northern climates.

The lobby should be so designed for ticket selling and collecting that the traffic will flow in a straight line, or nearly so, from the entrances to the box office to the ticket collectors. To avoid congestion, approximately two-thirds of the lobby should be planned for accommodating box offices and ticket purchasers. The remainder should be reserved for ticket holders, who should have direct access to admission gates.

The seating capacity and the number of seats in each section will determine the number of entrances and exits required. It is important that spectators be dispersed in a minimum amount of time. It is highly desirable to have exit ramps leading from stepped aisles. Ramps, stairs, and passageways should be as wide as the deck aisles served. Stairs or ramps not opening directly into a street or open space should have lanes of at least 20 feet in width leading out of the area.

Entrances and exits for structures should be located for accessibility and be adequate in size and number for crowd dispersal. When entrances and exits are located at the front of a structure, a low fence or wall should separate the walkway from the playing-field area.

Service and Auxiliary Units

If the field house is adjacent to the main gymnasium building and the natatorium, the requirements for lockers, showers, and toilets can, in some instances, be reduced. An underpass from the gymnasium to the field house may be desirable in order to make the gymnasium service units available to some participants in the field house. If the field house is not adjacent to the gymnasium, consideration should be given to the erection of a small building or a basement, simple in design, with dressing, shower, and toilet facilities, rather than use space for such purposes that might be used more advantageously for activities.

Convenient and accessible dressing units equipped with chalk and tack boards for the home and visiting teams should be provided. When the field house is to be used for interscholastic basketball tournaments and indoor track meets, consideration should be given to providing separate locker rooms with adjoining shower and toilet facilities. These units could be used regularly throughout the year by intramural participants and intercollegiate squads. It is desirable to provide passageways from dressing rooms directly to the basketball floor to avoid crowd interference.

A dressing room with adjoining shower and toilet facilities should be provided for staff members. These accommodations can also be used by game officials.

Separate toilet facilities in sufficient number for men and women spectators should be provided close to the seating areas. Toilets should be provided near traffic lanes. Where large crowds attend games, it is advisable to place supplementary toilet facilities off the main lobby.

A room for first-aid treatment should be provided if the field house program is planned to attract spectators. This room may also serve the purpose of a training room for emergency treatment of participants and for the prevention of injuries.

Provision for a lounge room may be advisable after consideration of such factors as available space and funds as well as the functions of such a room for clubs, members of athletic squads, letter men, officials and coaches, and visitors. An adjoining kitchenette is desirable.

Storage Space

Many field houses are constructed with insufficient storage space. It is essential to have adequate and conveniently placed storage space if the facilities are to be fully usable.

Space should be provided for equipment and supplies for the physical education, athletic, and recreational programs. Supply rooms should be large enough so that supplies and equipment can be cared for and issued from them. Shelves in storage rooms should be slanted toward the wall.

After a building is completed, it is impossible to add storage space unless that space is taken from areas designed for other uses. Thoughtful planning of storage space should be done when setting forth total space needs. Adequate maintenance and control over supplies and equipment is possible only when proper storage space is available.

A major consideration in connection with storage is the provision of adequate entrances to storage areas. A loading dock and elevator may also be required, depending on the type of supplies and equipment to be used.

STADIUMS

This consideration of stadiums is primarily concerned with the type of structure frequently needed for school and community use, with a capacity of 10,000 or less and with limited spectator accommodations. It should be obvious, however, that the basic considerations for such structures will also apply to larger units. Those responsible for planning stadiums should keep in mind that their creation is an integral part of the physical education, recreational, and athletic programs of the school and community, not divorced from them.

In the early stages of planning for stadiums, there should be joint effort of all concerned. The professional staffs of the schools involved should furnish the curricular and activity requirements. If the structure is also to be used by the community, representative civic and recreation leaders should be included in the planning. This process is necessary to enable architects and engineers to create functional facilities. In brief, those engaged in planning such structures should include all who will be expected to use them.

For the purposes of this section, the terms *spectator structure* and *seating structure* include both permanent and temporary outdoor seating facilities, while the word *stadium* refers only to permanent accommodations. Spectator structures provide seating from which people can satisfactorily view athletic events without inhibiting the activities of the participants. However, the possibility of employing spectator structures and fields for other purposes also warrants careful consideration. Seating structures can be justified more readily if they have multiple uses. In addition to serving athletic contests, these facilities are used for patriotic observances, plays and pageants, Easter sunrise services, anniversary celebrations, conventions, lectures, commencement exercises, mass meetings, demonstrations, exhibits, large religious assemblies, parades, drills, and band concerts.

The space underneath a stadium may provide physical education service and activity areas. These facilities should supplement rather than duplicate existing units. Representatives of groups affected and others who can contribute should participate in the planning.

Seating Capacity

If possible, the seating capacity of a stadium should be sufficient to meet present needs, with plans for expansion to satisfy predicted needs for a period of at least 20 years. The number of seats required will be influenced by the sports served; enrollment of the school or college; population and socioeconomic status of the town, city, and region; available public and private means of transportation; and planned expansion of the program. The provision of an excessive number of seats should be avoided because construction and maintenance costs make it impractical to provide accommodations that are seldom used.

Design

Traditional architectural designs for spectator accommodations are still the most popular and effective. These include the crescent, the rectangle, the muleshoe, the horseshoe, the bowl, and the "V" and modified "L" (see Figure 1).

The crescent design places the greatest number of seats opposite the center of action. This shape is usually of permanent construction and used for sports requiring a rectangular playing field. The front is parallel with the field, but the back and sides form a continuous curve the center of which is located on the midline of the field. In this design, the preferred seats are higher up, opposite the center of the field. Another design based on the crescent principle is composed of rectangular seating sections, the depth of which decreases as the units extend toward the goals. This latter design is economical because curved backs and sides are eliminated. Another advantage is that the greatest number of seats are concentrated within the 10-yard lines of a regulation football field.

The rectangle is the most common and least complicated structure. It provides for practical and economical expansion when necessary.

The muleshoe and horseshoe are two designs intended for permanent structures with large initial capacities. Except for bowed tiers in the horseshoe, they are similar. Better sight lines in the bowed tiers provide the advantage of facing spectators toward the center of action. This advantage, however, is reduced by the fact that curved construction is more expensive than straight-line forms. The open end of these designs allows for inclusion of a 200-meter straightaway for a track, plus additional space for field events. There is some merit in building a muleshoe stadium in stages, with the initial structure being rectangular.

The bowl stadium, built to handle large crowds, completely encloses the playing field, ruling out a 200-meter straightaway unless special provisions are made. Consideration may be given to adding a second deck as additional seats are required.

The "V" or modified "L" design orients two rectangular structures to form a right angle. Often the two are joined by a curved portion. This design is especially applicable to baseball seating.

The various shapes or designs should be applied to meet specific needs in terms of activities to be served and desired seating capacities. The use of fields and spectator structures for more than one sport affords maximum utility for money expended. Some sports are particularly adapted to the use

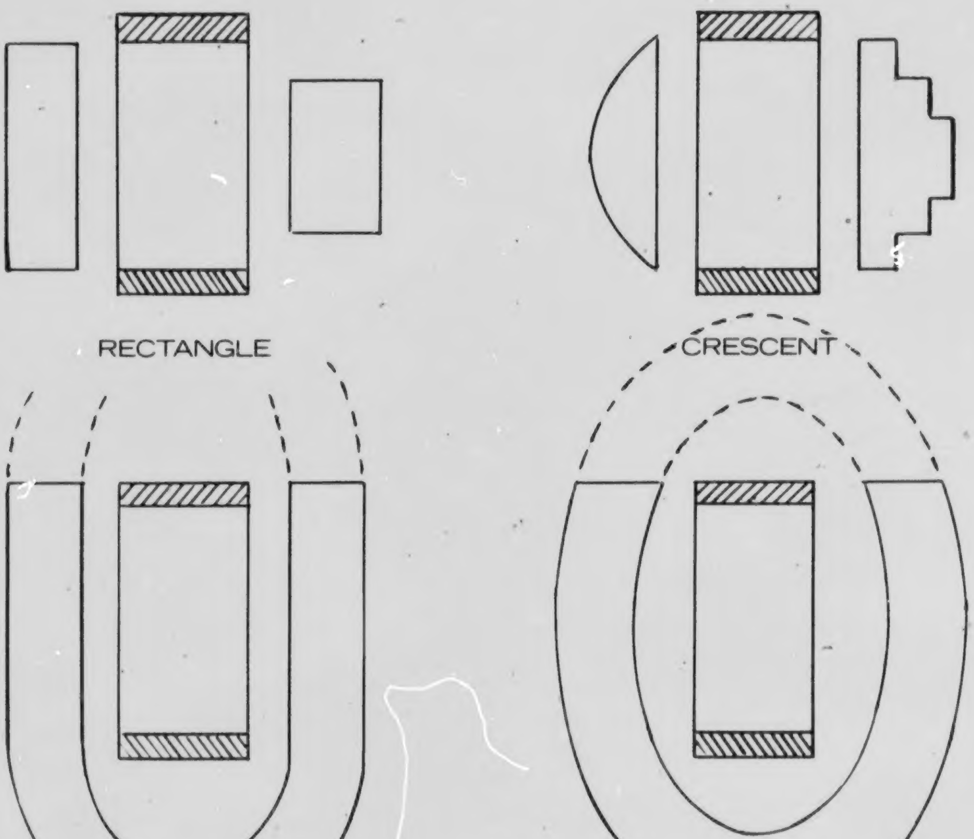

RECTANGLE
CRESCENT
MULESHOE
HORSESHOE
(THE BOWL SHAPE ENCLOSES BOTH ENDS AS INDICATED BY THE DOTTED EXTENSIONS)
THE "V" AND MODIFIED "L"

Figure 1. Shapes of Outdoor Spectator Structures.

of common areas and facilities. The single spectator structure for the combined football-track area is common. Spectators at such games as soccer, field hockey, speedball, and lacrosse may also be served by seating facilities for football. Planners should make certain that the field area is large enough to satisfy the space requirements set forth in the official rules for the various sports. Specifications for different types of playing fields are given in Part Three, Chapter 1.

All of the designs except the "V" or modified "L" can be adapted to seating structures for football and track. When fewer than 10,000 persons are to be accommodated, the rectangular design is desirable. For small crowds, the structure should occupy the centermost portion of the area opposite the field, but as capacity increases, the structure is extended toward the goals. In no event should the structure be placed closer to the boundary or playing area than provided for in the official rules.

Stands can be erected on the opposite side of the field to provide for additional and more favorable seating. If necessary, seating accommodations can also be provided at the ends of the field. Rectangular spectator structures can be permanently located, be demountable, or be mobile. Demountable or mobile units are sufficient for small crowds or when used as a supplement to permanent facilities. These units may be transferred to other areas where seating is required, thus affording maximum utility.

Rectangular spectator structures provide the most practical seating accommodations for baseball, softball, soccer, lacrosse, and other field games; tennis, outdoor basketball, volleyball, and other outdoor sports; and special events or demonstrations. For baseball, a structure can be located parallel to either or both the first-base and third-base lines. The most favorable view of tennis is from behind the ends of the courts. Seating facilities for other outdoor events should be adjacent to the activity area and as near as possible to the probable center of action consistent with the rules governing the activity.

Track-and-field spectator seating is generally parallel to the straightaway for the dashes. Some planners, however, have located spectator seating so that the structure angles gradually toward the straightaway end of the track. The front end of the structure nearest the starting line should be farther away from the track than the front end nearest the finish. This arrangement faces the spectators toward the most common center of continuing action.

The combined use of a stadium for softball, baseball, and football often results from the desire to use existing floodlighting. In most cases, sufficient seating facilities can be provided with a small permanent structure or by relocating demountable or mobile bleachers used for football.

The combination baseball-football field should be avoided if possible, and especially if planners do not intend to use artificial turf. Superimposing an infield upon a portion of the gridiron makes undesirable playing conditions for football and soccer. A baseball area that overlaps a track-and-field site presents safety problems. Competitors have had serious collisions on such combined facilities.

Site and Location

Spectator structures should be easily accessible to the users. These facilities should be on the school or college site and near the gymnasium so that locker, shower, dressing, equipment, and other service facilities can be used. Duplication of adequate existing facilities increases costs of construction, operation, supervision, and maintenance. Traffic movement and parking requirements should also be considered in site location.

Cities with two or more secondary schools should consider the construction of one stadium for their combined use. Teams from each school may practice on their own fields but play their regular games at the stadium. If possible, the structure should be located on or adjacent to one of the schools' site for reasons of greater accessibility, maximum use, and more efficient maintenance, operation, and supervision.

A primary requisite for a satisfactory site is adequacy of size. The site must be large enough to accommodate the play and safety areas for the sport or sports to be conducted, the proposed present and future seating, and service areas. The site should be flat or easily leveled. However, natural inclines of the topography can be used for support or partial support of a structure. Surface drainage of a site and adjacent areas as well as the subsurface soils and geological formations should also be considered.

Seating Decks and Supports

The main considerations in planning spectator structures involve seating decks, deck supports, seats, and means of ingress and egress. Several factors should govern the selection of materials used for seating decks and deck supports, including expected capacity, intended use of the structure, availability of funds, climatic conditions, and desired aesthetic qualities. Wood, stone, brick, steel, and reinforced concrete are the materials most frequently used. The inclusion of service and other facilities under the stadium makes mandatory a solid, continuous, and waterproof deck of either concrete or metal. Wooden treads and risers may be used if the underneath area will not be developed. Appearance, tensile strength, adaptability, exhaustability, durability, and cost of construction and maintenance are items that should guide the buyer in the selection of building materials.

Concrete, structural steel, wooden columns, and natural or artificial embankments serve as supports for decks of spectator structures. Reinforced concrete columns are generally used to support concrete decks. Steel decks are usually mounted on steel columns and beams. Either steel or wooden substructures support most wooden decks. The supporting structure of the stadium should rest upon foundations of concrete. The design of deck supports should meet structural strength requirements of state and local building codes, and the supports should be so located that they provide unobstructed spaces of the appropriate dimensions to accommodate proposed uses of the underneath portion of the stadium.

Stress standards should be considered at all times in stadium construction. Regardless of the materials used, all spectator structures should be designed to meet the following specifications: to support, in addition to their own weight, a uniform, distributed line load of not less than 100 pounds per square foot of gross horizontal projection; to resist a horizontal wind load of 30 pounds per square foot of all vertical projections; and to withstand a seat load of 24 pounds per linear foot of seats and a force of 10 pounds per linear foot applied in a direction perpendicular to the seats' length. Seating standards require that all seats and foot-boards carry line loads of not less than 120 pounds per linear foot.

Seating decks may be constructed of concrete, steel, or wood. Reinforced concrete is satisfactory, provided it is properly designed and constructed. One of the disadvantages of this type of material is its tendency to crack when it is used in a structure located in an area north of the frost line. The proper placement of expansion joints, the sloping of treads to the front, and the adherence to standards for materials used in the concrete are guidelines for reducing the deterioration and maintenance cost for this type of material.

Bent steel plates may be used in the construction of steel decks (prefabricated sections of treads and risers). This type of deck affords flexibility in expansion. A facility of this kind may be salvaged and moved to a new site, and it is a sturdy, durable, and watertight (if welded) structure. However, steel plates do tend to deteriorate if not painted regularly.

A structure with a seating capacity of less than 5,000 persons might be constructed of wooden treads and risers mounted on concrete, steel, or wooden substructures. The only advantages of this type of construction are lower cost and portability of the seating facilities. Deterioration of the wood and the almost constant maintenance problems are disadvantages.

Treads and Risers

In the seating deck of a spectator structure, the treads form the horizontal surface while vertical surfaces form the risers. To minimize expense, treads and risers should be as small as possible but sufficient in size for comfort and good view. The height of the first riser should be kept to a minimum because it affects the ultimate height of the entire structure and, therefore, the cost. The width of the treads is governed by factors of economy and comfort. A minimum depth of 21 inches is recommended for treads with backless seats. For structures without continuous seating decks, this measurement should be taken between the front edges of the seating surfaces of successive tiers. The minimum depth for treads supporting seats with backs is 30 inches. Tread widths remain constant except for the first tier, unless there is a railing, low wall, or fence in front, in which case additional space is required for spectator movement.

Drainage must also be considered in the design of treads for solid decks. A forward slope of one-half to one inch per tread will permit water to drain off rapidly, in addition to facilitating hosing the deck for cleaning purposes. Gutters and drains should be included for large structures. The standards for the size of the drain are based on the minimum ratio of one square inch to each 300 square feet of deck surface served.

State and local building codes set standards for aisles, entrances, and portals for spectator structures. Planners should be cognizant of such codes. Aisles may not be necessary in small seating structures. For structures with many rows and larger capacities, however, aisles are necessary. Sections between aisles should contain tiers with 21 to 32 seats. The first aisles should be located 11 to 16 seats from the ends of the structure. Horizontal walks are generally undesirable because persons using them will obstruct the sight lines of others. If such walks are used, the next tread above should be high enough to permit the spectators to look over those persons walking in front of them. In addition, the first tier of seats should be high enough to allow its occupants an unobstructed view.

Aisles should have a minimum width of 36 inches, and if divided by a portal or obstruction, each side should be at least 24 inches wide. Whenever the riser exceeds nine inches, an intermediate step is necessary.

The seating capacity and the number of seats in each section will determine the number of entrances and exits required. It is important that spectators be dispersed in a minimum amount of time. It is highly desirable to have exit ramps leading from stepped aisles. Ramps, stairs, and passageways should be as wide as the deck aisles served. Stairs or ramps not opening directly into a street or open space should have lanes of at least 20 feet in width leading out of the area.

Deck Walls and Railings

The ends, backs, and in some instances the fronts of the seating structures should be bordered by walls or a railing. These walls or railings should extend at least 12 inches above the treads and be designed to prevent spectators from sitting on them.

Sight Lines

Seating facilities should be constructed to provide spectators with a good view of the performance. Nearness and an unobstructed sight line to the desired points affect the quality of the accommodations. A sight line is a straight line from the eyes of the seated spectator, over the heads of others below, to a point on the field that represents the spot nearest the structure that should be in his field of vision (see Figure 2).

Recommended focal points for sight lines are as follows: for football, the nearest side boundary lines; for track, about knee-height of the runner in the nearest lane; for baseball, several feet behind the catcher; for side seating for tennis, four feet in toward the seats from the doubles boundary line; and for end seating for tennis, 10 feet behind the base line.

SEATING ARRANGEMENTS

Considerations involved in the design of seating facilities include the nature of the contest, the comfort and convenience of spectators, proper balance of cost and comfort, stadium cleaning, and maintenance expenses.

Back supports are generally unnecessary in stadiums because of the nature of the activity and the added cost of such supports. For planning purposes, an area of two by two feet, or four square feet per seat, should be allowed for bench seats. The height of the seats above the foot-support treads should be between 16 and 18 inches. Some designers make no allowance for seating other than directly on the treads. However, elevated bench seats are much more satisfactory.

Douglas fir, redwood, and southern cypress are the woods most used for bench construction, since long experience has proved them to be satisfactory seating surfaces. Such factors as decay resistance, bleeding, strength, slivering, and cross-section of grain warrant consideration in selecting the kind and quality of wood. Types of commercial covering that protect and aid in the maintenance of wooden seats should be investigated. Synthetic materials of plaster, Fiberglas, and the like, molded into seating structures, are now past the experimental stage. Extruded aluminum, natural or in color,

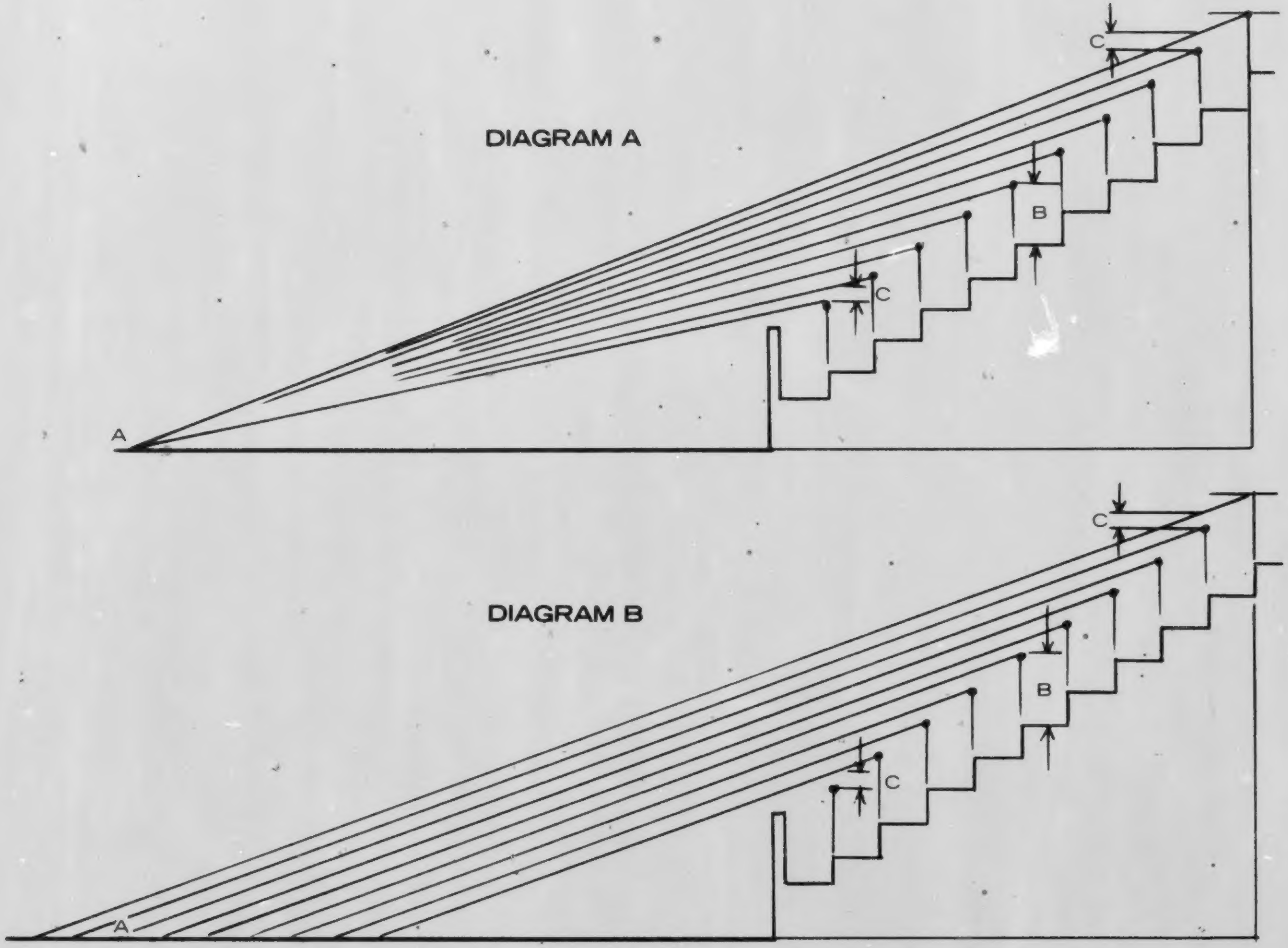


Diagram A shows a seating section with a gradual increase in riser heights. The focal points, "A," are same from all seats. "B" represents height from a seat eye level. "C" represents the distance from eye level to the top of a spectator's head.

Diagram B shows a seating section with constant riser and tread heights. As the seating tiers progress upward, each focal point is closer to the field.

These diagrams are adapted from *Concrete Grandstands*, Portland Cement Association, Chicago, 1948.

Figure 2. Sight Lines and Focal Points.

is fabricated into seats and may be found in many modern stadiums. The natural type is neither hot nor cold, withstands weather, defies insect destruction, and drains and dries quickly and cleanly.

Developing the Space Underneath Stadium Seating

The space underneath a stadium can serve a variety of purposes, but considerable planning for using this space should occur at an early stage. Planners should not consider service units in this section of the stadium if no more than 15 rows of seats are contemplated. Under-stadium development is economically advisable only if the cost of construction of needed facilities is less than it would be at other available sites. Many colleges and universities may find it more feasible to develop the area underneath the stadium than to have the various functions that might be served there dispersed to more remote areas.

A variety of uses can be made of the space. The most common facilities to be located in this area are public toilet rooms, storage rooms, concession booths, and dressing rooms for competitors. Activity areas, classrooms, and offices might also be included in this area. One or more lounge rooms for pregame meetings and/or luncheons with the press or for other similar purposes may be provided if space is available. Other possibilities include auditoriums and band rooms, dormitories and dining halls, instructional areas, maintenance shops, housing for the caretaker, basketball courts, auxiliary gymnasiums, practice facilities for baseball and track, and squash and handball courts.

Steps in planning the area under the stadium include a determination of the capacity and type of the proposed structure, a study of other present and probable future facility needs, and a determination as to which of these needs can best be satisfied through development of the space. Three important questions should be answered in determining the feasibility of developing this portion of the stadium. Is it possible to construct the facilities in keeping with previously determined requirements? Will these facilities permit the intended use? Is it economically practical? If the space under the stadium is to be developed, other important factors that should be considered are whether the structure is above the ground and/or of permanent construction; whether the seating deck is watertight; the space requirements of the various facilities, which will indicate the location and design of columns, trusses, beams, and other supports; and whether the substructure is designed to support the seating deck and, at the same time, to provide a framework for the construction under the stadium.

Ramps, stairs, walks, and other stadium service facilities should be located to satisfy the intended purpose, but also with consideration of facilities under the stadium. Common errors made in the development of this area are the failure to provide a watertight seating deck—with the necessary inclusion of expansion joints—and insufficient fenestration and ventilation.

Field Surface

Every consideration should be given to the latest developments in surfacing. The basic functions to be served by the stadium in the particular institution will determine the final selection.

There is no longer any reason to have dirt areas that become mud areas on playgrounds or fields. With artificial turf, the use of an outdoor field can be increased 300 to 600 percent in a normal winter. Football stadiums can be designed to serve for baseball and track. They may also be designed to use the same lights. Artificial turf can be used all day, everyday, for everyone.

Artificial grass has arrived for the following reasons: no allergies, fewer injuries, no bald-headed fields, consistently good turf, and minimal maintenance. It is good for all grass sports—soccer, golf, tennis, and lawn bowling. There are other synthetic surfaces that service smooth-surface sports such as basketball.

Lighting and Electrical Facilities

General lighting and electrical outlets should be planned to satisfy the requirements of the specific spectator structure. If night games are to be played, illumination is necessary for all areas to be used by spectators. The playing areas should receive extra illumination in situations where the last row of seats is several hundred feet away from the action on the field. Uniform illumination is necessary for proper player judgment of the ball and its trajectory. Therefore, there should be uniform light throughout the playing area and the space around it.

Adequate light should always be provided in the stands. Some illumination should be provided on the ground immediately surrounding the playing field. Standards for the design of floodlights are published by the Illuminating Engineering Society.

Manufacturers have a wide variety of lighting systems, direct and indirect. Some of the most popularly used systems are mercury vapor, fluorescent, incandescent, luminaries, quartz-flood, filament, Lucalox, and multi-vapor. (For lighting specifications, see Part Two, Chapter 7.)

Communication Facilities

Accommodations for reporters, sports broadcasters, television and motion-picture cameramen, and scouts should be planned in the original design. The football press box should be located opposite the 50-yard line, preferably on the west side of the stadium. Baseball press boxes usually occupy some portion of the stand behind home plate, and tennis matches can best be served by a press box behind the end of the courts. A means of communication between the press box and the field is necessary.

Provision should be made for a press box in the original design of the stadium. It should be of sturdy, permanent construction and should be high enough to permit the occupants to see over the spectators standing in the row immediately in front. It should be heated and enclosed, with a glass front.

In cold climates, consideration should be given to providing an area for sports photographers at either end of the press box. A protected and heated structure providing overhead cover, with an open area in front from which pictures could be taken, might be constructed for a nominal sum.

Stairs and/or an elevator should provide access to the press box, and the latter is recommended if the press-box floor is more than 30 feet above ground level. Public toilet facilities should be immediately adjacent, with a minimum of two water closets or one for every 10 occupants.

Provisions should also be made for a public-address system. Utility, telephone, and special radio requirements should be determined by sound and electrical engineers and should be included in the original design.

Additional Accommodations for Public Events

Scoreboards are essential for football, softball, and baseball fields. Time clocks are also desirable for football.

It is advisable to have the scoreboard designed as an integral part of the structure, especially in the case of larger stadiums. For activities attracting a small number of spectators, mechanical or movable scoreboards may be practical.

One public telephone should be provided for every 1,000 spectators, with a minimum of two for the stadium regardless of the seating capacity. Booths should be enclosed to eliminate noise and should be placed in accessible locations.

For suggestions on concession booths and dressing units for participants and staff, see the discussions in the section of this chapter on field houses.

The availability of electricity, gas, water, and sewer connections significantly affects the use and validity of a spectator structure. The concession center, press-box area, rest rooms, scoreboard operations, field illumination and watering, and many other functions depend on one or more of these utilities.

Public toilet units should be located in an area that is easily reached from the seating area. Because the stadium structure is ordinarily not heated, all plumbing should be constructed so that it can be completely drained of water, and water lines should be buried beneath the frost line of the locality. Toilets used by large groups should have circulating (in and out) entrances and exits.

Stadium cleaning can be expedited by providing the recommended deck slope and drains with hose bibbs located not more than 100 feet apart. Paving the surface under the stadium seats and installing drains and hose bibbs designed to prevent freezing facilitates stadium cleaning.

Provisions For Future Expansion

If there is a possibility that the size of the stadium will need to be increased in the foreseeable future, the method of expansion should be determined and the necessary details incorporated in the original footings and other construction. Insofar as possible, the requirements for future expansion should be built into the initial structure.

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Part Four–Recreation and Park Areas and Facilities

Chapter 1

RECREATION CONCEPTS

RECREATION IS PEOPLE

We are living in an era of rapid social and technological change, which is producing new awareness and acceptance of leisure and recreation as important parts of the life style of most Americans. Technological advances have helped to give our rapidly expanding population more leisure time and more money and more mobility with which to enjoy it. These facts alone make planning for park and recreational facilities mandatory.

But the most important thing is that we are dealing with people—the most important asset we have today. *Recreation is people.* Therefore planning for park and recreational facilities must be undertaken with, for, and by people.

Most of the planning for park and recreational facilities is based on traditional facility guidelines, land-use maps, and outdated concepts of what is good for the public. Today planning must reflect the needs and wants of the people. Instead of recreational programs being developed to utilize facilities as built, the facilities must be designed and constructed to provide for the recreational programs as projected to serve the people. Buildings must be designed to meet program requirements rather than programs designed to fit existing facilities.

INVOLVEMENT OF THE COMMUNITY

People must be involved in the planning of park and recreational facilities, if the facilities are going to be successful. The federal government recognizes this fact and requires public involvement in the planning for federally subsidized programs. There are dangers in this public involvement, e.g., the development of pressure groups for special facilities or ideas of grandeur based on unrealistic concepts. However, when proper coordination and communication exist, facilities resulting from joint planning by the public and the park and recreation agency will be more than good facilities. They will be symbols of community pride.

There are many ways to involve the public in the planning process, but the following three have proven most successful.

Attitude, Interest, and Opinion Survey

A survey of leisure behavior and attitudes, as developed by the Office of Park and Recreation Resources at the University of Illinois, is used to determine the needs and desires of the people within the community or planning area for activities in conservation and recreation. To this end, current demographic characteristics, availability of leisure, leisure behavior patterns, and opinions concerning the provisions of programs and facilities are analyzed. Results of this study then provide input to the overall, comprehensive plan for recreation and parks.

Involvement of Organized Groups

The inclusion and involvement of organized groups on the basic planning team is another possibility. For example, Civil Advocacy Depots (CAD's) have been developed to represent the public in planning federally subsidized programs.

Successful planning with organized groups must be based on open communication and trust. The park and recreation agency must thoroughly explain the project requirements and options—finances available, timetable, location, and so on—as the initial step in the joint planning. Everyone who is involved must have all the facts in order to help make decisions. Leadership must be provided by the park and recreation agency, but the lack of open and responsive communication and coordination in joint planning with organized groups could result in dissension and destroy any possibility of success for the proposed facility.

Public Meetings

The use of public meetings to present and discuss proposed park and recreational facilities has been very successful for the Philadelphia Recreation Commission. No new facility development is initiated without a public meeting with the people of the neighborhood. The local political representative opens the meeting and turns it over to the commissioner of recreation who, with his staff, explains the projected development. Following the meeting, the ideas and comments of the public are studied, and where valid, changes are made in the plan. An important point, however, is that all persons who attended the public meeting must be notified of the changes.

It is impossible to set forth the best method of community involvement. The ability of the people in different communities will vary, and the involvement must be consistent with this ability.

Special Planning Considerations for Metropolitan and Congested Areas

Today approximately 80 percent of the U.S. population lives in metropolitan areas. Lack of open space, coupled with poor environmental quality in many of our urban areas, has created a growing public concern for recreational facilities and services and the need for special planning considerations.

- The lack of open space and, in many cases, the lack of economic resources make it mandatory that all governmental and public agencies cooperate in planning facilities for maximum use. Recreational use of public housing facilities, social and health care programs in recreational centers, and swimming pools adjacent to and part of fire stations are some examples of how the public can make maximum use of facilities.
- Additional or secondary uses of all facilities, public and private, must be considered. For example, the parking lot of a large industrial plant can be used for recreation on weekends with little additional cost if planned properly.
- Because the mobility of people in dense urban areas is often restricted, facilities must be provided where the people are, rather than in places reachable only by extensive travel.
- Plans should be revised for maximum use of existing facilities. Twenty-four-hour use might be a possibility in some areas.

Planning for Multiple Use

Planning facilities for many kinds of recreational uses is a major consideration in the establishment of playgrounds, parks, and other recreational properties. Multiple-use facilities require space that can accommodate varied activities for all age groups during varied times—e.g., of the day, week, month, season, or year—and on varied surfaces and enclosures—e.g., macadam or lawn, chain link fence or walls. Obviously the activity will dictate the facility but most activities are associated with specific times and or seasons. Golf is a morning game in spring, summer, and fall, and skiing is a midday activity in winter. Basketball and hockey are considered winter activities, baseball is played in spring and summer, and football is a sport for autumn. Thus, a facility that is planned to accommodate a single use becomes an expensive investment, because it lies idle part of the time.

The Educational Facilities Laboratories of the Ford Foundation is encouraging new concepts of encapsulated space and synthetic grades to broaden the use of facilities. There are a variety of activities that can take place in three major types of space—turf areas, paved court areas, and water. In addition, areas for snow and ice sports and buildings for recreational activities may be designed for multiple programs.

FIELD GAMES

The multiple-use turf area can accommodate many kinds of field games and games requiring smaller spaces. Its size, shape, and treatment will depend on the needs and space available. It should contain large and small open-turf areas with peripheral planting, benches, and tables. The small-games field is used for active games of low organization, informal class work, storytelling, and creative free play.

The field-games area is laid out for large-space games such as field hockey, touch football, football, soccer, speedball, baseball, and softball. Fields, backstops, and goals for the various games should be located in such a way as to permit overlapping use of the area during different seasons.

COURT GAMES

The multi-use paved area is an all-weather space used for court games requiring a hard surface, such as basketball, volleyball, badminton, tennis, paddle tennis, handball, and shuffleboard. It also provides for small games requiring areas of variable size, such as dancing, roller skating, and games of low organization.

Concrete or asphalt surfaces are commonly used, but the possibility of synthetic covering may also be considered. Local conditions will determine the type and particular specifications.

The court-games area may be combined with the small-games paved area as a multi-use space, or there may be a series of separate court areas. Basketball, volleyball, badminton, tennis, and shuffleboard are games that can be played on small areas with smooth playing surfaces. Enclosures and backstops will be needed and, in some cases, lighting for night play. If a court game is to be laid out on a multiple-use paved area, removable net posts should be provided and suitable plates or covers supplied for capping the postholes.

AQUATIC SPORTS

The size and shape of the water body for aquatic programs will depend on the activity. If a general swim area is required, no specific size or shape is necessary except for varying depths to suit the swimming abilities of the users.

A special swim area for such activities as diving, racing, and synchronized swimming can be combined with general swim areas to provide a multiple-use water area. The depth, size, and shape will be dictated by the special uses. In all cases a pool, lagoon, or beach front should accommodate general and special uses to become a multiple-use area.

SNOW/ICE SPORTS

The multiple-use snow ice area may also be separated or combined for general or special use. A ski slope can be used only for skiing, or it can be used for sledding, ski bobbing, and other activities. The ice rink can be used only for hockey or also for figure, general, and exhibit skating.

RECREATIONAL BUILDINGS

Recreational buildings designed for multiple use provide for maximum utilization of the facility and allow the park and recreation agency the opportunity to maximize the benefits of the program and maintenance staff. The facility should be designed so that all areas can be used for a variety of activities with a minimum of effort. A single area, properly designed, can accommodate meetings, classroom activities, physical activities, art and music activities, and numerous other uses.

Planning for Adaptation to Changing Preferences

The population's tastes and pursuits are constantly changing, as they experience new opportunities and as they are exposed to new ideas. As activities and their rules and regulations change to make the game more exciting, and as new activities are created or introduced from other cultures, people alter their patterns of play. As manufacturers and inventors generate new toys, equipment, games, and events, new leisure habits are created. Changing recreational preferences require that indoor and outdoor areas not be restricted with permanent spatial and architectural fixtures designed for specific activities in a set period of time. There must be flexibility built into indoor and outdoor facilities comparable to the open classroom in the field of education.

Multiple-use areas and buildings have the quality of adaptability as the needs and interests of the users change. Basketball may be a popular sport for several years and then give way to volleyball. Baseball may fall to hockey or golf to tennis. But mutiple-use areas retain their value because they are designed for changing programs.

The character and location of the population are also constantly changing. The ethnic, socioeconomic, and such other demographic features as age and family size vary within a neighborhood as the generations come and go. A community that is planned on the basis of a static population soon has many obsolete features. The population is more mobile today; one out of every five families moves every year. Within the family, members are in a continued state of flux as children go to school, camp, grandma's, or college. The increase in second homes also changes the demands on recreational services in a community.

Planning for areas and facilities must be adaptable to the changing patterns and pleasures of the population. Without adequate planning, facilities may be constructed with built-in obsolescence.

Planning to Suit Changing Technologies

The numerous new products and systems that have evolved during the past decade have had a tremendous influence on recreation. It is said that 90 percent of the inventions now registered have been invented during this past decade, and the percentage is likely to increase in the next decade. This new technology has affected both man and the machines, materials, and methods he uses.

New technology has changed man both physiologically and psychologically. It has given him more leisure and a longer life. It is beginning to take him off the assembly line and has given him new forms of transportation and communication. It has produced synthetics in turf, ice, and snow as well as in wood forms and concrete structures. It has given him new kinds of recreational equipment and enclosures. The new technology has reshaped housing, playing, teaching, and other life functions.

Planners should be aware of new devices and equipment for use in all aspects of life (see Part Two, Chapter 8). Wood, steel, plastic, concrete, and asphalt are not the common construction materials of today used in facilities, utilities, or devices. The space age has provided new combinations of materials more durable, washable, and moldable. New materials have opened a new field of recreational opportunities.

Facilities that are planned on the basis of traditional use of machines, methods, or materials only build in obsolescence. Facilities should not be built to last 50 years but rather to take advantage of an ever-changing technology to meet foreseeable requirements and the lowest maintenance cost.

Planning to Eliminate Architectural Barriers

The population for whom facilities are planned consists of many people who are handicapped by some disability. Statistics reveal that one out of every ten persons has a handicap of some type. If planners continue to design facilities only for those who are not handicapped, a large portion of the population is deprived of access to and use of the facility. Every effort should be made to plan every facility for every person. All architectural barriers should be eliminated.

Part Two, Chapter 6, describes in detail the techniques that should be employed to eliminate architectural barriers. These guidelines should be adhered to in all planning. The handicapped should also be involved in the planning process to ensure that activities as well as facilities will be provided to serve their requirements.

Chapter 2

INDOOR COMMUNITY AREAS and CONCEPTS

CONCEPTS

The types of planning units—neighborhood, community, city or school district, and county or region—and their relation to one another are discussed in Part One, Chapter 1. Relations among planning units, however, are often changed by physiographic or demographic changes occurring in the planning entity. A new neighborhood might be formed by a significant change in housing or in nationality, or a community might be divided into an additional neighborhood by a new expressway. These factors are taken into consideration when defining units.

Use of Planning Units

Population units form the basis for planning programs and activities and their resultant areas and facilities. The specific groups of residents must be the basis for evolving any services—unless the population entity is defined and identified by the planning agency, the requirements of the locality cannot be ascertained. The characteristics and use of every area and facility are delimited by a design load that reflects the population characteristics. The park and recreation agency, in order to plan and manage its services properly, establishes its activities and facilities on the demands of a known population with given economic and ethnic determinators. The larger the planning and managing agency in responsibility, the broader the population entity with which it will be concerned. An undefined and unidentified population unit results only in arbitrary and indiscriminate determinations and allocations of services providing no accountability and relevancy. Every effort should be made to delimit the study and service unit to provide for recreational programs and areas in the most effective and efficient manner.

Park-School Concept and Beyond

The park-school is discussed as one of the basic concepts in this publication in Part One, Chapter 1. It is necessary, however, for park and recreation planners to go beyond this concept and look to the possibilities of joint facility developments with public housing authorities, public libraries, municipal health centers, police and fire stations, and the like. For example, when low-income families are concentrated in public housing developments, the importance of recreational facilities is often ignored or underrated. A recreational facility planned, financed, and operated jointly by the recreation and the housing agencies can better provide opportunities to meet the needs of the people in the area on a more economical basis.

General Recreational Buildings

Recreational buildings should be functionally designed to reflect a varied program of activities for all ages and both sexes. These buildings should be planned to meet the needs and interests of all people in the neighborhood or community. They should provide a safe, healthful, and attractive atmosphere in which every person in the community or neighborhood has the opportunity to enjoy his leisure by participation in activities of a social, inspirational, cultural, or physical nature.

Because of advances in medical science, people live longer. Thus, the percentage of the aging in our population is increasing. In addition, it is estimated that one out of seven people in our nation has a permanent disability. Therefore, there is a greater challenge than ever before to prevent the construction of architectural barriers, which make it difficult for the aging and the disabled to participate in the recreational program. (See Part Two, Chapter 6.)

Almost without exception, recreational areas require some type of structure that will fulfill program needs and, at the same time, blend aesthetically into its surroundings. In terms of function, types of buildings may range from the simple picnic shelter to the complex community recreational building with its variety of special service facilities. Such buildings may vary in design from the rustic, depicting the style of early colonial days, to the contemporary, representing the most modern architectural styles.

Growth in the scope and complexity of the recreational program has created a need for buildings to provide facilities for a wide variety of recreational activities. Unlike many of the early structures, present-day buildings provide for adaptability and multiple use. This change from the simple to the complex has stimulated the development of a variety of recreational buildings. These are classified by function and then categorized by size.

The planning of a recreational building demands a precise and logical approach. Since a recreational building reflects the unique needs and interests of a neighborhood or community, the specific design will vary, but the preliminary considerations of planning objectives will be the same.

The successful incorporation of accepted planning objectives will ensure maximum utilization of the building. The initial functional spatial specification and the continuous re-evaluation of the architectural specifications of the building prior to its construction should be considered in terms of the following questions:

- Has the most effective use of the entire structure been determined, and is all the space used?

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- Does the preliminary sketch include all of the essential facilities necessary to fulfill the program objectives?
- Does the layout provide for flexibility in use and for future expansion?
- Does the floor plan permit convenient access to, and facilitate circulation within, the building?
- Does the floor plan provide for ease in supervision and administration of the building?
- Have individual rooms been located so as to encourage multiple use within safety limits?
- Has the building been designed so as to ensure opportunity for its use by all members of the community, including the aging and disabled?
- Does the design encompass accepted aesthetic qualities that relate harmoniously to the surroundings?
- Is the building designed so as to ensure joint use with other public or private agencies?
- Is the building so designed that it will permit economy in construction and subsequent maintenance?
- Is the building designed so as to ensure sufficient and convenient storage?

The standards used for determining the size requirements of recreational buildings are usually based upon the population to be served and the program to be conducted in the building. One means of determining size is to use a square-footage-to-population ratio. This may be determined by allowing approximately two square feet per person to be served. For example, if the building is to serve 8,000 persons it should be approximately 16,000 square feet in size.

The Neighborhood Center

The mainstays of the recreational program are the recreational opportunities provided at the neighborhood level. The neighborhood recreational center, designed to serve an area of approximately 8,000 persons, is believed by many experts to be the best recreational facility investment.

This building encloses 15,000 to 25,000 square feet, depending on the number of people to be served and the program requirements. The size will depend also on whether the building is a separate entity or part of a park-school complex where facilities are available in the school.

The neighborhood center usually includes the following facilities:

- Multipurpose room or rooms
- Gymnasium (if not available in neighborhood school)
- Shower and locker rooms, when a gymnasium is provided
- Arts-and-crafts room
- Game room
- Kitchen
- Restrooms
- Lounge and lobby
- Office
- Large storage areas.

The Community Center

The community recreational building functions beyond the primary purpose of serving a single neighborhood. It is designed to offer a more diversified program to meet the complete recreational needs of all the people in the community.

The size of the building depends on (a) the number of people to be served, (b) the projected program plan, and (c) whether it is a part of a park-school site or a separate building. This building usually contains 20,000 to 40,000 square feet of space, and it is usually located in a major recreational area such as a park-school site or community park.

The community center usually includes the following facilities:

- Multipurpose rooms
- Gymnasium
- Shower and locker rooms
- Stage and auditorium (sometimes combined with gymnasium)
- Rooms for programs in the arts (art, dance, music, drama)
- Game room
- Kitchen
- Restrooms
- Lounge and lobby
- Office
- Large storage areas
- Clubs or classrooms
- Possible specialized areas as program dictates (racket courts, gymnastics, weight and exercise room, photography workshop, and so on).

MULTIPURPOSE ROOM

The multipurpose room should be designed to accommodate such activities as general meetings, social recreation, active table games, dancing, dramatics, music, concerts, and banquets.

The area of this room should be approximately 2,000 to 3,000 square feet. It should be rectangular in shape, with a minimum width of 40 feet. The minimum ceiling height should be 16 feet.

Vinyl-asbestos flooring is recommended for this type of facility. The floor should have a nonskid surface to prevent many common accidents. The floor should also be level in order to permit multiple use for meetings, dancing, dramatic presentations, and so on.

The entrance should contain double doors and should be at the end opposite the stage. Each door should have a minimum clear opening of at least 32 inches. The doors should have a removable mullion.

GYMNASIUM

In order to obtain maximum benefit from the gymnasium, it must be designed to provide for a variety of other activities, such as folk, square, and social dancing, banquets, and roller skating, in addition to the athletic programs.

The size of the gymnasium should be at least 90 by 100 feet, with a minimum height of 22 feet. This size will permit a basketball court of 50 by 84 feet, with additional room for telescopic bleachers seating approximately 325 spectators on one side of the gymnasium.

Provision should be made for a mechanical ventilating system and air-conditioning should be considered where climate dictates. It is preferable to have no windows in the gymnasium. If necessary, windows should be placed on the north side at a height of 12 feet or more, and they should be provided with protective guards. The wainscoting in the gymnasium should provide clear, unobstructed wall space from the floor to a height of 12 feet.

Maple flooring is commonly used. The cork spring clip or other type of expansion joint should be installed on all four sides. If suspended apparatus is used in the gymnasium and wall attachments for control ropes and chains are affixed to the wall, these attachments should be at least seven feet above the floor level and should be recessed.

Whenever possible, noncontact (nonmarring) furniture should be used. Design characteristics of such furniture also facilitate safer use by the aging and disabled.

In a masonry building, particularly in one with concrete reinforced frame, stainless-steel eyebolts should be installed in each corner and at each column for the hanging of decorations, thus eliminating the necessity of driving nails or screws into the walls. These bolts should be located within 12 inches of the ceiling in the smaller rooms and at least 15 feet high in the gymnasium.

Recessed drinking fountains and cuspidors should be provided and should be located in areas where they will cause a minimum amount of interference. Water fountains should be hand- or hand-and-foot operated, with up-front spouts and controls. Protective floor covering or drainage at the base of the fountain should be considered to avoid floor damage.

SHOWER AND LOCKER ROOMS

A room for the purpose of changing clothes is necessary and should be close to the gymnasium. There are two accepted plans for checking personal apparel: (a) locker rooms with metal lockers, and (b) dressing rooms with a checkroom for checking clothing in wire baskets or nylon bags.

If the lockers are to be used in connection with outdoor sports, they should be located so the players will have access to them without going through the entire building. The suggested minimum requirements for the locker room in a community recreational building are 200 lockers for men and boys and 150 lockers for women and girls. The placement of lockers should take into account the space requirements of the disabled.

The floor of the locker room should pitch to a central drain, or drains, to facilitate cleaning and washing. The junction of the wall and floor should be coved. In the women's locker room, the ratio of dressing booths to lockers should be 1 to 10. Hair driers and nonbreakable liquid-soap dispensers are also recommended.

The use of galvanized-wire baskets or nylon or plastic bags and a checkroom is growing in popularity. This system will accommodate the same number of users in about one-fourth of the space required for metal lockers. However, there is no saving of space required for dressing.

If a swimming pool might be constructed on this site, dressing rooms should be located and arranged so as to serve both the gymnasium and the pool.

The size of shower rooms is dependent upon the extent of the facilities and the number of persons to be served at one time. Adequate ventilation should be a primary consideration.

For men and boys, it is suggested that approximately 12 shower heads be provided, spaced a minimum of four feet apart and six feet above the floor level. For women and girls, it is recommended that a minimum of six group shower heads and three individual shower-and-dressing booths be provided. Shower heads should be four and one-half feet above the floor level. For the disabled, two folding "L" seats should be placed in opposite corners of each group shower to facilitate both right-hand and left-hand approaches.

In the construction of the shower-room floor, drainage gutters four inches deep and 8 to 10 inches wide placed around the perimeter of the shower room will provide a sanitary means of drainage. The central portion of the shower floor, raised above the depressed area, should drain toward the shower drains.

A carborundum-impregnated ceramic tile, or its equal, will provide a nonslip surface.

The temperature of water feeding into the shower heads should be 120° F, controlled by means of a mixing chamber rather than by individual control. Vandal-proof shower heads should be used.

STAGE AND AUDITORIUM

A stage and related facilities may be built in conjunction with the gymnasium or multipurpose room. If space and funds allow, however, a separate unit is preferred.

The stage proper should be about 20 feet in depth, and the proscenium opening should be at least two-thirds the width of the room. It is desirable that the approach to the stage from the floor of the main room be by inclined ramp with a nonskid surface to facilitate the physically disabled and aging and to accommodate the movement of equipment.

It is desirable that the room be equipped with a modern public address system, permanently installed with matched speakers and outlets for additional microphones and phonographic equipment. Consideration should be given to a master control from the office of the building. All stage lighting should be modern and should be controlled from a dimmer-control cabinet equipped with a rheostat.

The base and wall of the room should be equipped with electrical outlets to accommodate floor and table lamps, motion picture equipment, floodlights, and other electrical apparatus. A heavy-voltage line may be necessary. Provisions should also be made for installation of television program equipment.

The entrance should contain double doors. Stage doors should be of sufficient width and height to facilitate the movement of scenery. It is desirable to have a door at the rear of the stage area to permit the handling of stage properties and scenery. Adequate exit doors should be provided and should be equipped with panic hardware. Door frames and thresholds should be flush. All door openings should be in accordance with the specifications of the American Standards Association.

Space should be provided for the storage of chairs, tables, and portable staging. This space can be under the stage or in an adjacent storage room provided with dollies having swivel ballbearing fiber or rubber-covered casters.

Acoustics are an important factor in an auditorium and should be kept in mind in the selection of materials for walls and ceilings. It is desirable to have rigid acoustic materials for ceilings, because they are more economical and discourage vandalism better than suspended acoustical tile.

ARTS AND CRAFTS ROOM

A separate room for arts and crafts is desirable. However, if this is not possible, then at least one club room should be equipped for crafts, with provision for gas, compressed air, and a modern sink with hot and cold water. The sink should have a clay trap.

Ample storage cabinets, closets, or lockers should be included for the safe storage of craft materials, unfinished projects, and exhibit materials. Base and wall plugs should be provided in all club rooms for the operation of electric irons, sewing machines, power tools, movie projectors and other equipment. If a kiln is used, it should be placed in an adjoining room for reasons of safety and should be equipped with a heavy-duty 220-volt electrical outlet. Bulletin boards and exhibit cases may be used to display completed projects.

GAME ROOM

The game room, approximately 30 by 64 feet in size, is designed for a variety of games, including pool and table tennis. In planning this room, sufficient storage space should be provided for the various items of game equipment and supplies to be used.

This room should be close to office supervision and should be acoustically treated. The choice of floor material should be carefully considered because of the heavy traffic usually prevalent in this room. Windows should be placed high in the walls to reduce glass breakage. A chair rail or wainscoting to prevent the marring of walls should be installed to a height of three feet above the floor. Whenever possible, noncontact (nonmarring) furniture should be used.

The game room should include tables for table tennis, billiards, and box hockey. The table surface for table tennis may be any material that will produce a uniform bounce not more than nine inches or less than eight inches when a standard ball is dropped from a height of 12 inches. It should be marked with three-quarter-inch white lines and a one-eighth-inch service line. (See Figure 1.) Billiards or pool has various table sizes, and several players may participate at one time (see Figure 2). Box hockey requires a frame of planks two by twelve inches with four holes in the end. Center boards are 3.5 inches wide and 4.5 inches high, cut into the center of the end boards and spaced two feet apart. The game is played with two hockey sticks and an old baseball.

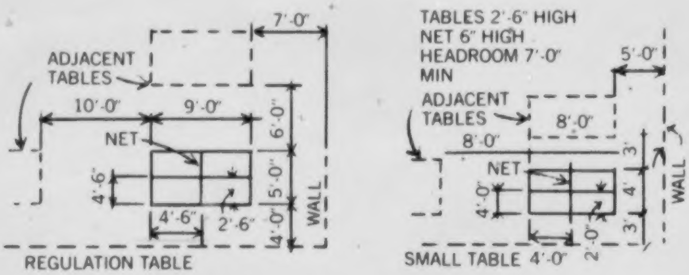

Figure 1. Table Tennis.

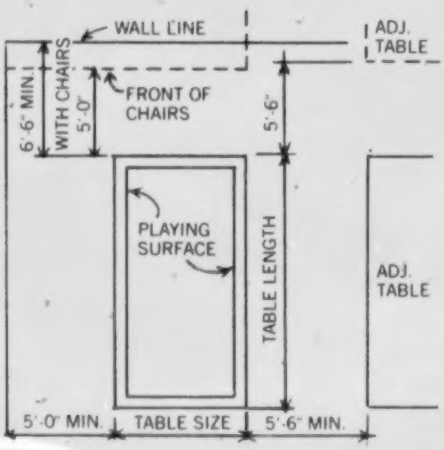

Figure 2. Billiards and Pocket Billiards (Pool).

DIMENSIONS FOR BILLIARDS & POCKET BILLIARDS

	PLAYING SURFACE		TABLE SIZE	
TYPE OF TABLE	W.	L.	W.	L.
ENGLISH (SNOOKER)	6'-0"	12'-0"	6'-9"	12'-9"
STANDARD POOL OR BILL.	5'-0"	10'-0"	5'-9"	10'-9"
STANDARD POOL OR BILL.	4'-6"	9'-0"	5'-3"	9'-9"
STANDARD POOL OR BILL.	4'-0"	8'-0"	4'-9"	8'-9"
JUNIOR POOL	3'-6"	7'-0"	4'-3"	7'-9"
JUNIOR POOL	3'-0"	6'-0"	3'-9"	6'-9"

TABLE HEIGHT 2'-6" ±

KITCHEN

The Pullman kitchen or kitchenette is usually desirable for most community and neighborhood recreational buildings. If large dinners or banquets are to be served, provision should be made for a full-size modern kitchen that conforms to local health regulations and has a free floor space at least 54 inches wide.

The kitchen should be located near the club rooms and the gymnasium, so that it can be used for small gatherings in the club rooms and for large banquet gatherings in the gymnasium. The kitchen is often placed between two club rooms and made available to both rooms by the use of aluminum roll-up doors.

Adequate storage space, cabinet space, and electrical outlets for such appliances as the refrigerator, range, dishwasher, and can openers should be provided. Exhaust fans should also be installed.

RESTROOMS

Restroom facilities should be designed to serve both indoor and outdoor areas. They should include soap dispensers, mirror, paper-towel dispenser and/or hand dryer, and waste receptacle. Mirrors should have metal frames and be recessed into the wall so they cannot be torn off.

Toilet fixtures should be hung from the wall for ease in cleaning. In restrooms where several fixtures are used, one fixture of proper height for young children and the disabled should be included. Lavatories should be of enamel-coated iron or stainless steel rather than vitreous china.

A flush-valve water closet, with the valve 24 inches above the top of the fixture (or three feet above the floor) is preferred over a tank fixture. Automatic valves for water taps in showers and lavatories are recommended to reduce water loss caused by taps being left open. Hose bibbs should be installed in each restroom and/or shower room, at a height sufficient for buckets to be placed under them.

The floor should be pitched to a central drain for ease in cleaning.

LOUNGE AND LOBBY

The lobby of the recreational building is the space just inside the entrance. The lounge should open off the lobby and, if possible, should be close to the central office and to the multipurpose room and/or gymnasium. The lounge and lobby are often combined into one room. When the rooms are combined, it is suggested that the size of the lobby-lounge be approximately 600 to 800 square feet.

This facility should be attractively lighted and should contain a wall-mounted, recessed drinking fountain and a built-in electrically lighted trophy case and bulletin board. Appropriate space should be allowed for public telephones, and at least one telephone should be installed so as to accommodate a person in a wheelchair. Adequate space, preferably recessed, and electrical and water connections for automatic vending machines should be included.

The entrance doors of the lobby present a problem from the standpoints of aesthetics, safety, security, and vandalism. Solid-glass panels—from ceiling to floor—and solid-glass doors are quite popular and attractive, but their use must be carefully studied. Since glass doors and panels can be easily broken, good aluminum doors with a minimum of glass are preferable.

Carpet floor covering is desirable for the lounge and lobby area; however terrazzo, quarry tile, and patio tile are sometimes preferred when cigarette damage to other floor covering is a possibility.

Office

An office of approximately 120 square feet is suggested. The office should be located so as to provide maximum supervision and preferably be close to the main entrance. Sufficient window space should be provided for supervision; however, provision for privacy is necessary to handle discipline problems and small meetings.

It is often recommended that there be an adjoining shower-dressing unit with a floor-surface area of not less than 100 square feet. This unit should contain a shower, toilet and lavatory, clothes closet, and first-aid supply cabinet.

Opening off the director's office should be a storage closet with a burglarproof door for storing valuable supplies and equipment, such as the motion picture projector and public address system.

STORAGE AREAS

One of the most common errors in planning recreational buildings is the lack of sufficient storage space for equipment, maintenance, and custodial purposes.

An area adjacent to the gymnasium should be provided for storing apparatus and equipment. It should have a six-foot-wide opening, with flush, louvered doors and a flush threshold, to permit passage of the most bulky equipment.

The minimum size of the storage room should be approximately 250 square feet. Provision should be made for storage of inflated balls, bats, softballs, and other supplies, either in separate cabinets or a special closet. Appropriate bins, shelves, and racks are suggested. In addition, a recessed alcove for the storage of a piano is desirable.

The maintenance storage room varies in size, depending upon the adjacent outdoor space and the size of the building. The room is ordinarily located on the ground level, adjacent to the outdoor areas. An outside entrance should be provided by means of a burglarproof door sufficiently large to permit the passage of motorized maintenance equipment. Recessed wall shelving and cabinet storage should be provided for tools, supplies, and equipment. This space should also contain hot and cold water, a slop sink, a lavatory, a water closet, and a clothes closet. The floor should be concrete and should be pitched to a central drain. The junction of the floor and wall should be coved.

A supply closet equipped with a slop sink and space for mops, pails, brooms, and cleaning supplies should be centrally located on each floor level.

CLUB OR CLASSROOMS

Experience indicates the desirability of providing a minimum of 500 square feet of floor space per club room. For community recreational buildings, at least three to five club rooms should be provided for multiple use. At least one large club room should be located adjoining the kitchen.

When windows in club rooms and lounges are placed high in a wall, they are not broken as often as low windows and they also provide more space for furniture, bulletin boards, pegboards, chalkboards, and exhibits. Since broken window glass is a major problem, a nonbreakable type of windowpane is preferable. Windows may be omitted and sky domes and vent domes used. By omitting windows, the need for drapes, Venetian blinds, and curtains—all items subject to vandalism—is also eliminated.

A chair rail or wainscoting to prevent the marring of walls should be installed to a height of three feet above the floor. Whenever possible, noncontact (nonmarring) furniture should be used. Radiant heat from the floor in rooms where programs for small children will be conducted is a possibility to be considered.

PHOTOGRAPHY ROOM

A special room can be provided and equipped as a darkroom. Ventilation should be provided through lightproof ventilators. Hot and cold running water, special light plugs (both wall and base) and photographic sinks for developing and washing prints should also be provided. A mixer is desirable to control the water temperature accurately. A filter should also be provided if the water quality is not good. Doors should be lightproof.

MUSIC ROOM

The size of the music room should be determined by the potential number in the choral or instrumental group using this facility at any given time. A guide commonly used is to allow 20 square feet for each participant. Provision should be made for the storage of music, instruments, band uniforms, and supplies. Shelves are commonly used for storage of musical equipment.

AUXILIARY GYMNASIUM

The auxiliary gymnasium is for such activities as wrestling, weight-lifting, tumbling, fencing, and apparatus work. Acoustic treatment for this room is desirable.

The size of the room and height of the ceiling will depend on the various activities for which this facility will be used. The floor should be treated with material that will withstand the use of such equipment as heavy weights.

At least one well-ventilated storage room will be needed for equipment and supplies used in the auxiliary gymnasium. If the apparatus is to be cleared from this room, an additional apparatus storage room should be provided.

INSTRUCTOR'S OFFICE

If the recreational program is of considerable size, there should be an office for instructors and leaders. It should be approximately 120 square feet in size and should be adjacent to the gymnasium.

A dressing room opening into this office should be provided for the activity leaders. This facility should contain a shower, water closet, lavatory, and clothes closet. Proper ventilation should be provided for all rooms.

CHECKROOM

The size of the checkroom will depend on the magnitude of the program. This room should open into the lobby and should be equipped with a Dutch door, shelves, and portable hanger racks.

SPECIALIZED RECREATIONAL BUILDINGS

Many cities and communities provide recreational programs that require specialized facilities. While the construction of these facilities can be justified in the majority of cases, care must be taken to provide for maximum year-round use. The specialized centers should be centrally located to serve all the public.

ART CENTER

In recent years many cities have constructed a community art center to satisfy the public demand for programs in the arts. The size of the facility will be determined by the number of people to be served and the type of art programs to be conducted. Generally, art centers will include work areas for ceramics, sculpture, painting, and sketching. Depending on the interests in the community, a center may also include facilities for woodworking, lapidary, stonecutting, and other arts and crafts. Some art centers include facilities for dance, music, and dramatic classes and programs as well.

Preschool Center

Preschool centers for day care, Head Start, and nursery school programs are being built in some communities with the aid of federal funds. These buildings are smaller than neighborhood center buildings, and the design scale is geared to preschool children. Generally the centers include a large multipurpose room, small rooms for small-group activities, an office, possibly a kitchen and eating facilities, and ample storage space. Special care should be taken to ensure good acoustic treatment in the center.

SENIOR CITIZEN CENTERS

Senior citizen centers are very similar in design to neighborhood recreational centers. However, more emphasis is placed on facilities for the arts, areas for discussion and rooms for passive games than for large-scale physical activities. While a gymnasium is seldom found in a senior citizen area, a large multipurpose room is needed for square dance, shuffleboard, and similar activities.

The senior citizen center should be a single-floor building, and special care should be taken to eliminate all hazards such as steps and protrusions on walls.

Swimming Pool (Natatorium)

Many neighborhoods and communities have a considerable interest in swimming and demand that a swimming pool be included as part of the recreational building. For maximum year-round use, the indoor-outdoor pool is recommended. The construction cost of this type pool is greater, but the value of having a year-round rather than a seasonal activity is more important to the community or neighborhood. (See Part V for complete information on swimming pools.)

Teen Centers

While teen centers have been very popular and continue to be built, the trend today is to construct multi-use centers that will provide opportunities for teen programs along with other activities. For example, a teen office and lounge are provided in many community recreational centers.

When a separate teen center is desired it should include the following:

- multipurpose rooms
- gymnasium
- shower and locker rooms
- rooms for programs in the arts
- restrooms
- game room
- lounge and lobby
- office.

Indoor Tennis Facility

Indoor tennis facilities are increasing at a rapid rate in areas where weather prevents more than five or six months of outdoor play. The building can be constructed from steel, concrete block, or brick. There is some use of air-supported "bubbles" with mixed results. The facility contains two major areas, the courts and the clubhouse.

COURTS

Many types of designs are possible for an indoor tennis facility. Ideally the courts should be constructed in modules of two courts, which can be accomplished by providing sufficient space between each two courts for a separating net or curtain or by providing structural separations between each two courts.

Excellent lighting is the key to a successful operation. Direct lighting with fluorescent fixtures is most common. Good results are also obtained with indirect lighting by bouncing vapor light off a light-colored ceiling. Lighting should provide a *minimum* of 100 footcandles evenly distributed on the court. Placement of fixtures should avoid any glare in players' eyes while serving or taking overhead shots. (See Part Two, Chapter 7, for additional lighting specifications.)

Court surfaces vary from standard asphalt to many synthetics. Highly cushioned surfaces give slower play and higher maintenance costs. Resilient surfaces are recommended, but the degree of resiliency can be a matter of judgment.

Unobstructed overhead should be at least 30 feet over the center of the court, and 35 feet is better. A two-court battery should be at least 120 by 120 feet in order to provide sufficient room for backcourt play.

Temperatures should be maintained at 60 to 65 degrees. Gas radiant heating has proved to be most economical. Adequate ventilation is required to avoid humidity problems during the cold season and to provide playing comfort in the warm season. Air-conditioning is a questionable need because of cost of construction and operation.

CLUBHOUSE

The clubhouse should be designed to serve the players' needs in a relaxed and pleasant atmosphere.

Space is required for men's and women's dressing rooms along with shower facilities. The practice of assigning permanent lockers to individuals should be avoided so that a limited number of lockers can be provided. For example, in a four-court building the maximum locker requirements would be 32 lockers each for men and women, if permanent lockers are assigned.

Space for a pro shop should be provided, for sale of balls, rackets, and wearing apparel. Racket stringing is a desirable service.

A nursery room for the small children of tennis-playing mothers is most important. Office space, storage, and lounge areas are needed. Some indoor tennis facilities have also provided such optional features as saunas, exercise equipment rooms, whirlpools, and steam rooms.

Other Specialized Facilities

In some communities, there is a need for such specialized facilities as bowling lanes and indoor riflery and archery ranges. Many cities provide a large convention or civic center. Most larger cities need museum facilities that include art, natural history, and science museums; aquariums; planetariums; historical centers; and so on. Expert technical assistance should be obtained when planning any of these facilities.

Chapter 3

OUTDOOR COMMUNITY AREAS and FACILITIES

Growth projections for the next 20 years provide evidence that few, if any, metropolitan areas in America have sufficient open space to meet the demands of the future. It is imperative, then, that planning boards of all types, at all governmental levels, review old master plans and develop new ones.

As open space becomes less and less available, greater consideration must be given to multiple use of these lands and every measure taken to utilize them in the best and most efficient manner. It is highly desirable that municipal and school authorities acquire, plan, and develop areas for joint use. This process calls for professional guidance in the fields of planning, designing, and engineering, and for the advice and counsel of professionals in the fields of education and recreation.

There is also a need to utilize the thinking and experience of others who, by training and day-by-day assignments, are qualified to contribute to the planning. The most efficient and successful planning is accomplished when everyone in the organization, particularly those who will be identified with the finished product, have an opportunity to participate in the planning process. Those who are to be served should also have a voice in the planning, through community meetings where they have an opportunity to express their interest and needs.

STANDARDS

A variety of standards for the size, location, and number of educational and recreational areas and facilities have been proposed over the years by persons with long experience in the operation of such areas and facilities and have been widely adopted and used as a basis for planning. The standards have been valid insofar as they have been formulated to encourage spaces and places that make possible a program to serve the basic needs of people for physical education and recreation.

Such standards, however, are not valid in prescribing specific activities or facilities for every neighborhood. While they are a useful guide in the acquisition and construction of a property, standards can seldom, if ever, be applied completely or without modification because a typical or common situation is seldom found. Standards are formulated to indicate a basis for the intelligent development of local plans. Therefore, the standards for areas and facilities should be reviewed and appraised for each planning unit and modified whenever changing conditions warrant their revision.

The present standards for areas and facilities—developed with the cooperation of private planning firms, public agencies, and service organizations at the local, state, and national levels—have been widely endorsed throughout the United States and have provided the basis for recommendations in scores of long-range plans for school, park, and recreational systems. The proposal that at least one acre of recreation and park space be set aside by urban areas for every 100 of the present and estimated future population has been more widely accepted than any other space standard. However, this standard does not relate to the demographic or physiographic character of particular locales and is becoming obsolete. Professional and governmental authorities, including the National Recreation and Park Association and the National Park Service, have pointed out the desirability of providing an even higher ratio of land to population in towns and small cities.

Modification of this general standard has been suggested for all planning entities based upon local requirements for populated cities. Some municipal planning officials have expressed the opinion that the development of large outlying properties owned by the municipality would help meet the recognized deficiency in the inner municipality. However, this proposal should be considered as a practicable substitute indicative not just of necessity, but also of feasibility. The National Recreation and Park Association, in National Park, Recreation and Open Space Standards, recommends that a minimum of 25 percent of new towns, planned unit developments, and large subdivisions be devoted to park and recreation lands and open space.

The old National Council of Schoolhouse Construction had recommended that an elementary school provide a 10-acre site, with an additional acre for every 100 pupils. The junior high school should provide a minimum site of 20 acres, plus an additional acre for each 100 pupils of predicted ultimate enrollment. The Council further recommended that senior high schools provide a minimum of 30 acres, plus an additional acre for each 100 pupils of predicted maximum enrollment. These standards are also becoming obsolete with changing concepts.

In the past, location standards have generally set a radius of a quarter mile for neighborhood areas, a half mile for community areas, and so forth. Such radii do not take into consideration the land types, user types, and such barriers as roads, streams, and railroads. Actual studies of recreational behavior patterns verify people tend to form recreational groups within their physical neighborhood and with others of similar social backgrounds. The resulting patterns might follow or be divided by arteries, depending upon whether transportation is provided. The shape of the service zones, when plotted, tends to be amorphic.

Old number standards related to the number of tennis courts or swimming pools per thousands of people, and so forth. Such numbers do not take into consideration the land or people and the climatic and geographic locale of the planning entity. The specification and allocation of facilities should reflect the activities demanded and supply to meet the demands. Standards of so many facilities per thousand are arbitrary and are neither reflective of the requirements of the community or neighborhood nor universally applicable. A planning process of interaction and participation by the public should determine the number of facilities from one end of town to the other.

Recreational acreage should be based upon usage. Guidelines for acreage allocations for different park types are only illustrative. Every activity has a demand by the public. The demand for some activities is often met by the private or voluntary sector. Ski lodges, tennis centers, and other corporations all conduct marketability studies to ascertain the leisure needs of and extent of use by their clientele. Public agencies must initiate comparable studies to analyze demand. If the municipality can ascertain the number of occasions of use, the extent of turnover, the capacity, the use time, and the low/peak load for each activity, it can compute amount of activity stations and facilities for each activity group. This analysis is comparable to processes used to determine the indoor and outdoor space requirements for a school. The recreational acreage is then computed for actual facilities, for circulating paths and roads, for landscaping, and for other supportive features.

PARK AND RECREATIONAL AREAS

The different types of outdoor recreational areas described here represent a considerable variety of service units, which may be used in programs of athletics, sports, and physical education as well as recreation. Local conditions and situations will dictate to a large extent which types are to be used in any given locality. Hence, different combinations of areas and facilities will emerge as the solution to the problem of meeting the needs and interests of a particular locality. In every situation—neighborhood or larger geographic unit—the facilities are to be selected and designed to meet the requirements of the people they are intended to serve.

There is some controversy over parkland aesthetics as measured by the terms *active* and *passive* recreation. Many individuals with inherent interest in recreational or leisure pursuits associated with nature denounce the intrusion into parklands by tennis buffs or ball players. Obviously, these two groups have different attitudes toward and interpretations of the character of parklands. Parklands can be designed for both or either active or passive use without destroying the aesthetic values and associated amenities attributed to parks. The use of parklands should reflect the greatest good for the greatest number and the protection of the health, well-being, and safety of all. If a community is split over use of parklands, a cost-benefit analysis should be made to ascertain the feasibility and costs of trade-offs. Obviously, the character of the resources also influences such trade-offs. There is no sense in preserving a swamp that was artificially created and lacks any ecological value, but a natural swamp might be found elsewhere and preserved to meet specific needs and interests. There are alternatives in every planning process, and they should be considered. In all cases, the aesthetic values of a parkland, whether it is oriented to play apparatus or floral displays, does not have to be sacrificed because it is termed *passive* or *active*.

Abandoned industrial sites, such as strip mines, waste disposal areas, and sand and gravel pits, can offer tremendous possibilities for park and recreational development. In many cases, recreational use is not only the most beneficial, but the most economic use of such sites. The recreation planner must not overlook the possibility of obtaining these sites for public use. If possible, cooperative planning should be started while the site is still being used by industry so that landscape features can be developed to make it more appealing for recreational use.

Playlot/Mini-Parks

LOCATION, SIZE, AND FEATURES

A playlot/mini-park is a small recreational area designed for the safe play of preschool children.

As an independent unit, the playlot/mini-park is most frequently developed in large housing projects or in other densely populated urban areas with high concentration of preschool children. More often, it is incorporated as a vital feature of a larger recreational area. If a community is able to operate a neighborhood playground within a one-quarter mile zone of every home, playlots should be located at the playground sites. A location near a playground entrance, close to restrooms and away from active game areas, is desirable.

The space devoted to a playlot depends upon the total requirements as well as the total open space available for development of a particular site. It may vary from 2,500 to 10,000 square feet.

The playlot/mini-park should be enclosed with a low fence or solid plant materials in order to assist mothers or guardians in safeguarding their children. Careful thought should be given to placement of benches, with and without shade, for ease of supervision and comfort for parents and guardians. A drinking fountain with a step for tots will serve both children and adults.

Play equipment geared to the preschool child should combine attractive traditional play apparatus with creative, imaginative equipment. Such proven favorites as chair, bucket, and glider swings; six-foot slides; and a small merry-go-round can be used safely. Hours of imaginative play will be enjoyed with such features as a simulated train, boat, or airplane; a playhouse; and fiberglass or concrete animals. A small climbing structure and facilities for sand play should be included.

SMALL GAMES COURTS

The playlot/mini-park may also include courts and areas for such activities as hopscotch, marbles, and circle games. The entire small-games area can be used as multipurpose space. These areas are located primarily in neighborhood and community park-schools and may be used for both class instruction and recreational programs.

The small-games area should be a minimum of 25 by 25 feet, adjacent to the crafts-and-apparatus area. It should be well-drained and surrounded by a fence or shrubbery barrier for maximum safety and control. The surface should be of sandy loam, asphalt, or concrete pavement.

Hopscotch is a popular game with children. A special court may be marked off in one section of the small-games area (see Figure 1).

Marbles may be played on any firm, level surface. A court may be marked off as in Figure 2. The outline of the ring should be about one-half-inch wide. The cross is marked as a guide for placing the marbles. The lag and pitch lines are marked. The ring may be circled with a curb and the inside filled with clay.

Neighborhood Park-School (Elementary)

The neighborhood park-school is the primary area in planning for education and recreation. It is a combination of a neighborhood elementary school and playground. It is planned in such a manner that all areas and facilities are used to meet the educational and recreational interests and needs of the people living in a neighborhood. It is essential that areas and facilities be cooperatively planned for the dual purpose of instruction and recreation and that the school and community recreational programs be coordinated for maximum use of these areas and facilities by the entire neighborhood.

The neighborhood park-school should service an area with a maximum zone of one-half mile and a population of approximately 4,000 to 8,000 people. Any deviation in the population density (larger or smaller communities) may mean a change in needs or interests and thus may alter the service radius and/or acreage required for this installation.

The minimum area recommended for a neighborhood park-school is 10 to 30 acres.

As an illustration, this area might be developed as follows:

	Acres
School Building	2.0- 3.0
Parking	1.0- 1.5
Playlot and apparatus	1.0- 1.5
Hard-surface game courts and multi-use area	1.0- 2.5
Turf-games field	4.5- 5.5
Park area, including space for drama and quiet activities	3.0- 5.5
Buffer zones and circulation	2.0- 3.0
Recreation service building	0.2- 0.5
Corner for senior citizens	0.3- 1.0
Total	10.0-30.0

The school building should be at the edge of the area to provide for maximum utilization of the site, and playground equipment should be located far enough from the building to keep noise from interfering with class instruction.

A separate building containing the recreation leader's headquarters and public restroom facilities could be provided close to hard-surface and game areas, if not included in the school.

Hard-surface areas should be contiguous, to provide a large area for recreation and recess as well as physical education and intramural activities. The field area should be large enough for baseball and softball diamonds, for various field games, and for special events. Paths and walks between areas should be placed so as to avoid traffic over lawns, and the arrangement of facilities and landscaping should make for ease of supervision.

Neighborhood Playground

The neighborhood playground is the primary area in planning for recreation. It is established primarily to serve children under 14 years of age and should have additional features to interest teen-agers and adults. The trend in recent years is for the neighborhood playground to become the

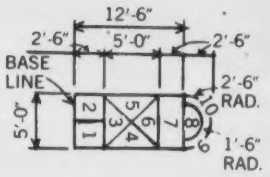

Figure 1. Hopscotch.

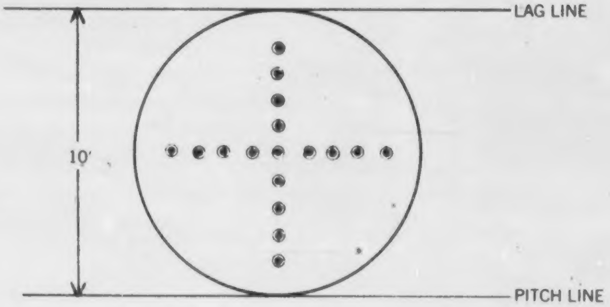

Figure 2. Marbles.

center of activity for the wide variety of needs and interests expressed by all residents. The more diversified pursuits of today's recreation consumer challenge the facility planner to provide for a broader program, with more attention devoted to multiple use by different age groups.

Modern planning for outdoor recreation at the neighborhood level places heavy emphasis on combining elementary school needs with those of the community. This type of joint development is treated in the immediately preceding section on the neighborhood park-school. Where elementary school facilities are unavailable or inadequate, or joint development is impossible, a separate playground will be needed in each neighborhood.

The neighborhood playground serves the recreational needs and interests of the same population served by the neighborhood elementary school. Its major service zone will seldom exceed one-half mile, with most of the attendance originating within a quarter-mile distance. It should be located close to the center of the area to be served and away from heavily traveled streets and other barriers to easy and safe access.

The neighborhood playground normally requires a minimum of five acres. The particular facilities required will depend on the nature of the neighborhood, with space being allocated according to priorities.

As an illustration, this area might be developed as follows:

	Acres
Turf area for softball, touch football, soccer, speedball, and other field games	2-3
Hard-surface area for court games, such as netball, basketball, volleyball, and handball	0.50
Open space for informal play	0.50
Corner for senior citizens	0.30-0.50
Space for quiet games, storytelling, and crafts	0.20
Playlot	0.20-0.50
Children's outdoor theater	0.15
Apparatus area for elementary age children	0.25-0.50
Service building for restrooms, storage, and equipment issue or a small clubhouse with some indoor activity space	0.15
Circulation, landscaping, and buffer zones	1-2
Undesignated space	0.75
Total	5 to 20

Depending upon the relation of the property to schools and to other recreational facilities in the neighborhood, such optional features as a recreational building, tennis courts, or a swimming pool might be located at the neighborhood playground. If climatic conditions warrant, a spray or wading pool may be provided. The following space for optional features should be added to the standards listed above:

	Acres
Recreational building	0.2
Landscape areas (if there is no neighborhood park)	2.0
Swimming pool	0.5
Tennis courts	0.4
Total	3.1

The addition of optional features may require provisions for off-street parking.

Neighborhood Park

The neighborhood park is land set aside primarily for both active and passive recreation. Ideally, it gives the impression of being rural, sylvan, or natural in its character. It emphasizes horticultural features, with spacious turf areas bordered by trees, shrubs, and sometimes floral arrangements. It is essential in densely populated areas but not required where there is ample yard space attached to individual home sites.

A neighborhood park should be provided for each neighborhood. In many neighborhoods, it will be incorporated in the park-school site or neighborhood playground. A separate location is required if this combination is not feasible.

A separately located neighborhood park normally requires three to five acres. As a measure of expediency, however, an isolated area as small as one or two acres may be used. Sometimes the functions of a neighborhood park can be satisfactorily included in a community or city-wide park.

The neighborhood park plays an important role in setting standards for community aesthetics. Therefore, it should include open lawn areas, plantings, and walks. Sculpture forms, pools, and fountains should also be considered for ornamentation. Creative planning will utilize contouring, contrasting surfaces, masonry, and other modern techniques to provide both eye appeal and utility.

Community Park-School (Junior High)

The community park-school (junior high)—a joint development of school and community—provides an economical and practical approach to a community-wide facility for educational, cultural, social, and recreational programs. This educational and recreational center is generally developed as a combination of a junior high school and a community park.

It is suggested that this facility provide service for an area with a zone of one-half to one and one-half miles. Such an area will normally contain 20,000 to 30,000 people, but population density and necessity may modify the size of the area served.

Based upon current formulas for establishing junior high school and community park sites, a minimum area of 25 to 40 acres is desirable.

As an illustration, the area could be developed as follows:

	Acres
Buildings (school and community recreation)	3-5
Turf-games field	6-8
Hard-surface games court and multi-use area	2-2.75
Tennis courts	1
Football field with 440 yard track (220 yard straightaway)	4
Baseball field (with backstop)	3
Playlot and apparatus yard	1
Park and natural areas	5-6
Parking lot	1.25-2
Buffer zones and roads and paths	3-4
Total	25

The following may be included as optional features:

Swimming pool (usually related to the building)
Nature-study trails and/or center
Day-camp center.

There are many other optional features that may be included in the community park-school, depending upon the needs and interests of the people and the section of the country, available space, topography, climate, socioeconomic composition of the community, and other variables. The following may be included as optional features:

archery range
band shell
boccie courts
botanical gardens
croquet courts
golf driving range
golf putting course
hard-surface dance area
horseshoe pits
ice-skating or roller-skating rink
boating lake
lawn bowling greens
lighted courts and fields
shuffleboard courts

In planning the community park-school, planners should consider the proper placement of apparatus and areas that serve multiple uses and bear in mind appropriate safety features in the development of each area or facility.

Community Park-School (Senior High)

A community park-school (senior high) is planned to provide facilities for young persons and adults to meet a wide range of educational and recreational needs and interests on a single site. It is generally developed as a combination high school and community park. It is essential that coordination and cooperation be exercised by school and municipal authorities to ensure the maximum development and use of all facilities for instruction and recreation both during and after school hours.

It is suggested that the population density of the area as well as the total population of the community determine the scope and size of the area to be served by this facility. For example, the higher the population density, the smaller the service zone.

Based on current formulas, a minimum area of 40 to 60 acres is suggested. The size should be determined by the program, which will include the physical education program as well as school and community recreational activities during out-of-school hours.

As an illustration, the area could be developed as follows:

	Acres
Buildings (including a gym and an aquatics center)	4-6
Turf-games field for instruction, intramurals, and interscholastic athletics practice	8
Hard-surface games courts and multi-use area	3
Tennis courts	1.50
Apparatus yard	0.12
Hard-surface court (shuffleboard and outdoor bowling)	2
Horseshoes and croquet turf	1
Football field with bleachers, 440 yard track	6
Baseball field	2-3.50
Playlot and apparatus yard	0.50
Natural woodland	3-5
Recreational building: senior citizens center	1-1.50
Parking lot and driver education course	4-6
Buffer zones, driveways, and paths	5
Total	50.12

For other features which may be incorporated into this facility, see the sections in this chapter devoted to the community park-school (junior high) and the city-wide or district park. An adequate number of each kind of facility should be provided to permit full participation by the number projected to use the facility.

The total community park-school should be landscaped to create a parklike setting that enhances and does not interfere with the instructional and recreational areas. The park should be planned for future expansion or modification.

Community Parks and Playfields

This type of recreational area is required in a community where it is not feasible or possible to acquire and develop a community park-school. The community park and playfield, like the neighborhood playground, is designed primarily to provide facilities for a variety of types of organized recreational activities, but it should also have the characteristics of a landscaped park. It usually serves as the playground for the children living in the immediate neighborhood, but its primary service is to a much wider age group. Thus it supplies a greater variety of facilities and more extensive service than can be justified at the neighborhood playground. The school child, teen-ager, young adult, hobbyist, senior citizen, and family group all find attractive facilities at the well-developed community park and playfield. Because there is no school building at this area, some type of indoor facility is needed. In many cases, a multipurpose recreational building is provided to meet this need.

City-Wide or District Park

The city-wide or district park serves a district of a large city or a total community of a small city. It should serve a population of from 50,000 to 100,000 with a wide variety of activities.

The ideal location for this area is in combination with a high school as a park-school complex. Where this is not feasible, consideration should be given to placing the park as close as possible to the center of the population to be served. The land available will be a determining factor in site selection. While the service zone will vary according to population density, a normal use zone is two to four miles. The size may be from 50 to 100 acres.

Depending upon available acreage, topography, and natural features, the city-wide or district park will contain a large number of different components. These would include, but not be limited to, the following:

A number of fields for baseball, football, soccer, and softball
Tennis center
Winter sports facilities
Day-camp center
Picnic areas (group and family)
Bicycling paths or tracks
Swimming pool
Water sports lake
Pitch-and-putt golf course
Recreational building
Nature trails
Skating rinks (ice and roller)
Playlot and apparatus
Parking areas
Outdoor theater.

The above facilities should be separated by large turf and landscaped areas. Natural areas and perimeter buffers should be provided.

County and Regional Recreational Areas

County and regional parks are relatively large land areas which are intensively developed for recreational purposes and which supplement the facilities furnished by the urban parks and recreational areas. Natural surroundings and spaciousness are emphasized to a greater degree than in the large city park, although some county parks in rural counties have characteristics of the community park and playfield. County and regional parks are commonly used for day-long or weekend outings. They supplement the resources of nearby communities and provide, for people of all ages, opportunities to engage in a variety of activities requiring more space than is afforded by most local parks. In some counties, consolidated or centralized schools provide facilities that serve not only children through the twelfth grade but people of all ages.

A second type of regional area is the preserve or reservation, which generally consists of extensive land areas with relatively little development for recreation and with major emphasis upon the preservation of their natural, scenic qualities. Conservancy areas, wildlife refuges, flood-control areas, and forest preserves fall in this category and are often accessible for recreation.

State and National Recreational Areas

The expansion of outdoor recreational activities and experiences has increased the significance of state and national facilities within reasonable access to urban centers. Interpretive programs to promote understanding and enjoyment of the geologic, historic, biologic, and other park features have been developed in state and national parks and have proved to be very popular. In many cases, they require special facilities to carry out the program. Campgrounds, picnic areas, and in some instances sites for summer homes are provided in state and national forests as well as some federal reservoirs, T.V.A. areas, and other federal properties. National recreation areas, seashores, and waterways are more recent concepts within the national parks system. Recreational activities in these areas are broad in scope and geared to mass use. These and similar developments should be considered in any comprehensive and cooperative program.

SPECIAL-USE AREAS AND FACILITIES

Bicycle Paths

Cycling is becoming an increasingly popular form of recreation for all age groups, especially since the development of geared bicycles, which make possible cycling over moderately rolling terrain without too much effort. In large community, city-wide, district, and regional parks, consideration should be given to providing separate bicycle paths. In addition to making possible a pleasant experience, these paths also serve to separate bicycle riders from motor and pedestrian traffic.

Bicycle paths can meander through wooded areas, skirt the edges of open areas, and in many instances parallel existing roadways or walks where it is possible to provide a suitable median or buffer strip.

Many communities are utilizing abandoned railroad right-of-ways for bicycle and hiking paths. The paths do not need to be highly engineered and can generally follow closely the existing ground surfaces so as to reduce grading to a minimum. Paths should be a minimum of six feet in width, hard surfaced, and on cut or fill sections, provided with a minimum shoulder of 12 inches. Bicycle stands should be provided adjacent to buildings or other points of interest or activity. In larger parks, and especially those somewhat distant from urban areas, rental facilities are not only desirable but also provide a source of income for the concessionaire or park authority. Facilities need be no more than a large stand to which cycles not in use can be securely chained or locked.

Bridle Paths and Rings

Horseback riding is popular with all age groups but is generally restricted to the larger park areas because of space requirements. Riding trails are usually a minimum of 10 feet in width to permit riders going in opposite directions to pass in safety. Except on very steep terrain, very little is required in the way of construction. Clearing, a small amount of leveling, removal of large rocks and boulders, and trimming or removal of low-hanging tree limbs constitute the major items. Most small streams can be forded, but an occasional bridge may be required as well as cross drainage on steep gradients. No special surfacing is required except that a gravel base may be needed in wet or boggy areas that cannot be avoided. Tanbark, cinders, and other materials are also used frequently on heavily used trails and in areas of concentrated use around hitching racks and in riding rings.

Stables and adjoining facilities, such as feed racks, holding corrals, riding rings, and hitching racks, should be located a minimum of 500 feet from the nearest public-use area because of the fly and odor problem. The size of these facilities will, of course, depend on the number of horses. However, the stable will ordinarily contain a limited number of horse stalls, a feed-storage room, a tack room, a small office, an toilet facilities for men and women. A fenced enclosure, commonly called a holding corral or paddock, into which the horses can be turned at the end of the day is required. A surfaced riding ring, sometimes encircled with a rail fence, is frequently provided for training novices in the fundamentals of riding. For dimensions of show rings, see Figure 3.

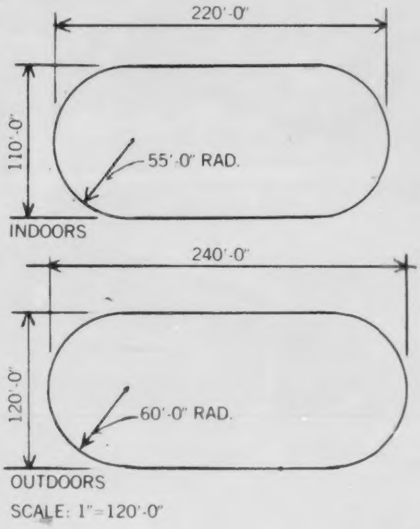

Figure 3. Horse Show Rings.

Golf Courses

The design, construction, operation, and maintenance of golf courses is too vast a subject to be covered in detail in this publication. The information herein is presented to introduce the reader to the basic requirements for the successful development of golf-course facilities.

Existing topography, vegetation, soil conditions, water courses, and property outline will dictate the amount of land required for a golf course. The following space requirements generally apply:

- Standard 18-hole golf course—120 to 160 acres
- Standard 9-hole golf course—70 to 90 acres
- 9-hole par-3 golf course—45 to 60 acres (including one or two par-4 holes).

These areas are normally sufficient to include a practice putting green, a practice driving range, the clubhouse area, and parking facilities.

The practice putting green should be equal in size to the largest putting surface on the course. Putting surfaces may vary in size from 3,000 to 15,000 square feet.

Where possible, fairways should be oriented in a north-south direction. Fairways with a line of play into the northwest are especially bad and should be avoided wherever possible.

The clubhouse is the control center for the golf course. Its primary function is to serve as the place where golfers register daily and pay fees for the use of the golf facilities. It is necessary that the clubhouse be located as near as possible to the first and tenth tees, the ninth and eighteenth greens, the practice putting green, and the tee for the practice driving range. The size of the clubhouse and the services it provides may vary with local conditions and intensity of use. The services may include various combinations of the following:

- Locker rooms
- Shower rooms
- Toilet facilities
- Dining room or snack bar
- Lounge
- Manager's office
- Pro shop (where golf merchandise may be purchased)
- Caddy-cart storage room
- Heating unit
- Maintenance storage room.

Careful attention should be given to the location of the pro shop so that maximum supervision can be given all clubhouse and course activities.

In order to ensure orderly use of the course, a starter must be provided to verify the golfers' registration on the course and to advise them when to tee off. A shelter separate from the clubhouse is often provided for the starter. If such provision is made, it must necessarily be located immediately adjacent to the first and tenth tees.

Marinas

America abounds in waterways. The myriad of inland lakes, the rivers and streams, the vast Great Lakes, and the thousands of miles of coastline serve to invite America's citizens to take advantage of this natural resource. In increasingly greater numbers, people are finding boating to be a recreational outlet that captures a greater share of their attention than ever before. Today boating commands more of the recreational dollar than baseball, fishing, golf, or any other single activity. There is a need for efficient, realistic, and functional planning for facilities to accommodate the present needs and the future growth that this recreational interest will precipitate.

The launching, mooring, and storage of yachts and rowboats are the function of a marina in a community—that waterfront area, publicly or privately owned and managed, that will serve the needs of the recreational-boat owner.

SIZE AND SCOPE

The size and scope of a marina will vary, depending on the requirements of the area involved. It is suggested that knowledgeable and experienced personnel be engaged to conduct a study of the number, types, and sizes of existing boats in the area, the number and size of existing berthing facilities, and the condition of such existing facilities. The survey should also include the potential population growth in the community and surrounding area to determine the future boat ownership. An accurate and comprehensive evaluation of such a study is the first step in planning a marina.

The data from the study will determine the next important consideration in laying out a marina: choosing the correct number of slips of each size that will be required. Based on the needs of the community to be served, planners will determine the necessary number of slips to accommodate boats under 18 feet long, those from 18 to 24 feet long, those from 25 to 36 feet long, and so on.

SITE SELECTION

Factors that will influence the final choice of a site are foundation material in both the land and the water area, tidal ranges (to determine types and detail of construction), possible wave hazards, prevailing winds, icing conditions during the winter, water depth (dredging is possible but quite expensive), and highways and transportation systems near the proposed site. Without this basic information, consideration of a site could well be wasted time and effort.

REGULATORY CONSIDERATIONS

After the site has been chosen and the type of marina determined, the planners must meet any legal requirements. A consultation with the district engineer is not only desirable but, in most cases, required. Local zoning, planning, construction, health, fire, and public-works ordinances must be satisfied before making large capital investments.

FINANCING

When the actual development of a marina is assured, accurate cost estimates must be prepared. Each of the different elements should be treated in detail to form a complete picture of the money to be spent on the project. These include such items as dredging, filling, and similar work; bulkhead walls and other shore protection; piers, wharfs, catwalks, floats, hoists, and railways; buildings, sheds, service stations, and their equipment; utilities, roadways, walks, parking spaces, and landscaping; stock of merchandise for sale; engineering, planning, and supervision costs; and operation and maintenance costs.

The method of financing a marina is an important factor. It will vary considerably, depending on whether the planners are proposing a publicly or privately owned marina. In any case, careful consideration of financing methods will assure a sound fiscal foundation for a proposed marina.

FACTORS TO BE CONSIDERED IN PLANNING

The location, community needs, and proposed use should determine which of several types of marinas will be planned. The boating industry generally makes a distinction between fresh-water and salt-water marinas. The operator of a salt-water marina must deal with the problems of erosion, rust, and exposure more than the operator of a fresh-water marina, so compensation must be made for these factors in the initial planning. The planner of a salt-water marina must also solve the tidal problem in designing the piers, slips, and ramps. Still another distinction is that the salt-water marina must generally accommodate more of the large yachts and cruisers that are capable of seagoing trips.

Some marina operators prefer to serve the small-boat owner because the initial investment in the facility is much less, as are operating costs and general maintenance. On the other hand, some marina operators concentrate on the larger craft on the basis that there is a greater margin of profit in servicing the more expensive boats. A great many marina operators serve both small- and large-boat owners and allocate space for each type of boat.

The docks and piers of a marina can be constructed of wood, steel, or aluminum. They can be either anchored or the more popular floating type. If wood is used, it becomes subject to damage from a number of causes, such as rot, termites or other insects, or marine organisms. Preservatives are commercially available to treat these conditions, and care should be taken to treat those areas most vulnerable, such as where wood rests on wood, where wood rests on cement or on the ground, on the end grain, and in joints, cracks, or crevices. Most metal will give more satisfactory service if protected with proper finishes. Base costs of metallic oxide or aluminum paints will effectively guard against corrosion or oxidation. The fixed, anchored dock will have piles driven to a solid footing, and the length of these piles will depend on the depth of water and penetration.

Most marinas have floating docks because these are more attractive and adapt more easily to expansions, changes, and rearrangement for varying boat sizes. To support floating structures adequately, a variety of materials and methods may be employed. Those most common are 55-gallon drums, wooden box floats, plastic foam (effective in salt water because it resists rust and corrosion), precast concrete floats, and wooden logs. It is well to apply a safety factor to any design of floating material to give some reserve buoyancy. For stability, long, thin, wide shapes are preferable to short, narrow, high shapes.

Slips are the mooring spaces for boats and extend out from either side of the dock or pier. Each boat has its own slip that must be easily accessible to the owner. Boat slips are the main revenue-producing facility at a marina, and rentals depend upon the size of the boat. Each slip must be equipped to secure the boat at both the bow and the stern. Many marinas offer catwalks on either side of the slip to facilitate the loading and unloading of passengers and cargo. Since many boats remain in their slip for days without being used, the marina operator may consider offering covered slips to boat owners. The coverings can be of wood, canvas, or aluminum and will vary in size with the boat being accommodated.

A launching ramp at a marina is a service facility that is in great demand by boating enthusiasts who prefer to keep their boats at home on boat trailers. The launching service becomes a source of extra revenue for the marina operator. The ramp may be either a floating or a permanent structure. The floating design has the advantage of being adaptable to tidewater locations by virtue of hinge plates that enable the far half of the ramp to rise and fall with the water-level variations while the near end is anchored to the shore and is held in place by piles. The permanent launching ramps are particularly suited to municipal waterfronts. This kind of ramp should be an extension of good access roadways and be near parking facilities for automobiles and trailers. Permanent launching ramps can be constructed of concrete, precast concrete, asphalt, cinders, or gravel. Determination of the material to be used should be based on such variables as soil conditions, climate, erosion, currents and waterfront conditions, availability of materials, and costs.

In the development of launching ramps, it is often desirable to cut back into a bank away from the shoreline to form the gradual slope of the ramp. To hold the earth embankment in place on each side of the ramp, small bulkheads can be constructed. In some cases, the bulkheads should extend into the water some distance in order to protect the underwater section of the ramp from erosion by currents and wave action. Bulkheads can be constructed of wood, concrete, or corrugated metal. Each of these materials has its advantage, depending upon soil and bottom conditions, tidal variations, seasonal changes in weather, and the possibility of floods and other abnormal conditions.

At marina locations that are bulkheaded and where space is limited, the launching of smaller boats can be handled by either a monorail and trolley hoist or a launching derrick. With these arrangements, the boats are lifted directly from the trailer, placed in position over the water, and lowered. Many of the larger and more expensive marinas have a hoist over each slip to keep the boats out of the water when not in use. These can be operated either by hand or electrically.

At coastal and larger lake marinas, the planners must include provision for a breakwater to lessen the destructive sea waves and resulting beach erosion and also to facilitate refueling and other normal dockside activities. The breakwater may be of the standard heavy stone-wall design or possibly the new "wave traps" of floating structures of fabric and plastic. In either case, breakwater engineering is skilled and precise work that requires consultation with professionals.

Another basic inclusion in a marina is some sort of structure to house administrative offices, the sales room for new motors and accessories, the repair shop, and perhaps a refreshment area. The extent of this building will depend on the needs of the marina as it serves its customers and the lengths to which the owner-management of the marina wishes to go to provide more than basic services.

Parking space for cars and trailers must not be underestimated in the planning of a marina. Too often, drivers who are inexperienced at hauling trailers can cause monumental tie-ups and delays if parking space is less than the demand warrants.

The above features are considered prerequisites for a successful marina operation. Beyond these, the planners of a marina can include numerous extras to enhance the service and beauty of their facilities, including private lockers; electricity for boats afloat or ashore; toilets and showers; restaurant services; overnight hotel accommodations; complete gas, oil, diesel-fuel, and boat-supply service; and complete year-round onshore sheltered storage.

Because marinas vary so greatly in their design, function, location, and capacity, it is virtually impossible to arrive at standard conclusions and judgments concerning a model marina. For instance, quoted costs for constructing a marina vary from several thousand dollars for a small, skeleton-equipped facility to several million dollars for a plush marina. Each planner will be able to apply the general principles to his unique circumstances. From that point, however, he must adapt his marina to the peculiar needs and characteristics of his community and to the use for which the marina is intended.

Swimming Pool

In many cases, a community recreational swimming pool will be located in a park with other facilities. The relation of the pool to the other recreational facilities should be considered in order to make the most effective and economic use of the total park.

The pool complex should be designed with the total projected use in mind. The determining factors in its design are the number, ages, and special needs of the persons who will use the pool.

If the pool is to be used for competitive purposes, all requirements should be strictly followed with regard to distances, depth, markings, and special features. See Part Five for regulation dimensions and construction guidelines for swimming pools.

Design of the recreational pool should include elements for all members of the family and their needs. The large number of children utilizing public pools might affect the amount of area with shallow water. For very small children, a separate fenced wading pool is recommended.

Studies indicate that in outdoor pools a large percentage of persons using the facility spend the majority of their time on the deck sunbathing and lounging. Adequate deck area should be provided to ensure maximum use of the pool.

A major consideration in designing the pool should be use of the facility by handicapped individuals. The locker room and pool areas should be accessible to and usable by persons with special limiting handicaps.

The number and placement of lifeguard stands and safety equipment should be made according to state and local regulations and the number of persons using a given area of the pool.

The locker room area should be designed to allow for maximum, orderly flow of patron traffic utilizing a minimum number of staff personnel.

Provision must be made for an adequate means of checking clothes for safekeeping. A system of lockers, baskets, or nylon checking bags are the most commonly used methods of checking clothes. If the pool is to be used on a year-round basis, consideration must be given to the greater number of clothing articles which must be handled during winter months. See Part Two, Chapter 5, for guidelines for locker room design.

An important aspect of the pool complex, both from a convenience and from a revenue standpoint, is the concession area. This facility must conform to all state and local health regulations and should be designed to serve the outside park area as well as pool patrons. Preferably, the concession area serving the inside pool patrons should be fenced from the pool deck area. No food or drink should be allowed in the swimming area. The initial planning should include consideration of designing this concession area to serve other facilities or areas of the park that would not have a concession area (e.g., tennis courts, ball diamonds).

Adequate parking areas should be provided for the pool and other facilities in the park. Placement of these parking areas should maximize the possibility for multiple use. In many cases, the same parking area can be used by various facilities within the complex. Planning should provide for easy access and orderly flow of traffic for the total complex.

Adequate provision for emergency and safety equipment should be made, and staff members should be trained in its use. A public address system is an essential element of the safety equipment as well as a convenience to staff and patrons.

Skating Rinks

ROLLER SKATING

Roller skating may be permitted on a multipurpose area or on sidewalks and streets under proper safety controls. If a rink is built, it is suggested that the area be 100 by 200 feet. A track for speed skating can encircle the figure or leisure skating area. The track should be banked at the curves, and the interior should be slightly pitched for drainage. Boundaries of the track should be defined with flags, wooden blocks, or pylons. Mark each turn with pylons, and indicate the starting and finish lines. The rink should be oriented so that skaters travel in a north-and-south direction.

The surface should be smooth wood (wide) or concrete sprinkled with rosin or a similar substance. If the areas for skating are speed rinks or multipurpose areas, there should be a fence around the area for safety and control.

ICE SKATING

Ice-skating facilities are feeling the impact of modern technology in more and more communities each year. Artificially frozen ice is replacing naturally frozen skating areas, meaning that refrigeration equipment is installed to ensure that skating ice is available despite adverse weather conditions. Artifical rinks provide smooth ice in moderate weather, a combination especially desirable for older skaters. No longer is it necessary to brave the bitter cold to enjoy good ice for skating. With the advent of mechanical freezing, the skating season has been extended from a 20- to 60-day average season to a 110-day season and, depending on climatic conditions, to as much as 240 days.

While natural-ice rinks have not gone out of style, artificial rinks are replacing them as central or regional facilities. Natural-ice rinks are continuing to serve as a supplemental neighborhood facility in many communities. A considerable number of skaters still prefer the rugged pleasure of an old-fashioned skating experience.

Artificial-Ice Rinks

The function of an artificial-ice rink will determine many of its characteristics, such as size, cover, seating, and service rooms. If it is planned to include hockey, the size should be 85 by 185 or 200 feet. The four corners are rounded to a 15-foot radius. A general-purpose rink is usually an outdoor rink of 85 by 185 feet surrounded by dasher boards and with warming-house facilities for a large number of skaters. It is generally agreed that the area per skater should be 30 square feet. Thus, the safe capacity of a general-purpose rink of the size mentioned would be 524 skaters. Many new rinks are being designed with a small additional ice sheet, commonly called a studio rink, for instruction and practice. There are many variations of the general pattern to accommodate individual needs and limitations.

After the function of the ice rink has been determined, considerable planning is necessary. It is best to engage an experienced design engineer who has a number of successfully operating rinks to attest to his skill. Some feel that to ensure quality, the engineering and supervision of construction should be the responsibility of the same person.

The proposed rink should be carefully located to gain the best position relative to sun exposure, wind velocity, and the blowing of such litter as dried leaves, dust, or papers. If an open rink is built, plans may provide for a cover or enclosure at some future date. The totally open rink or the roofed rink, open on two or more sides, appears to have been transitional phases in artificial rink development. Most recently constructed artificial rinks are totally enclosed so that inside air temperature can be maintained even in very mild weather.

Transportation and parking accommodations should also be considered in selecting a site. Preliminary planning may include such supporting services as skate rental and sharpening, a sport shop, and concessions. High-quality music for the rink should be ensured in the planning stage. If hockey is to be a part of the rink program, lighting will require advance consideration. During the planning period, subsoil should also be tested to ensure adequate drainage.

Refrigeration systems. A number of choices must be made in the construction of a refrigeration system (see Figure 4). They include (a) type of engine room, (b) extent of automatic controls, (c) number and size of compressors, (d) type of power supply, (e) number of brine pumps, (f) type of heat-rejection system, (g) type of refrigerant, (h) type of brine, and (i) type of floor construction.

Engine rooms that are assembled in the factory and installed as a complete unit on the job have replaced the site-built engine rooms, which require greater space and are more expensive. It is easier, however, to maintain and repair equipment in a site-built engine room.

Machines may be automatic or manually controlled. Automatic safety devices may be required by codes governing this type of installation. The slight additional cost for fully automatic operation will be amortized in a short time. Automatic controls can start the compressors when brine temperatures start to rise and shut them off as brine temperatures fall. The starting temperatures of the compressors can also be staggered for a more economical use of power. In addition, a brine-pump control can be set to stop brine circulation if the air temperature falls below the brine temperature, a condition that occurs often in the colder climates.

The compressor is the most complex piece of mechanical equipment in the system. An example will serve to illustrate the options to consider in choosing compressors. Assume that an outdoor ice rink of 85 by 185 feet needs 150 tons of refrigeration to maintain the rink surface. This refrigeration can be obtained with one 150-ton compressor, two 75-ton compressors, or three 50-ton compressors. When sunshine or rising air temperature causes the brine temperature to rise above the level set to start the chilling process, the compressors will start to work. In the case of one compressor, maximum power will be utilized, and when electricity is the power source, maximum demand rates will be charged even though a minimum of refrigeration is required. This expense is greatly reduced when two compressors are used, and a

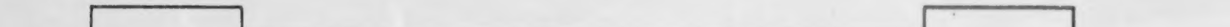

Figure 4. Refrigeration System.

still greater saving is effected when the capacity is divided among three compressors. The greatest power-cost saving occurs during long periods of cold weather when minimum refrigeration is required.

The refrigeration plant may be operated by either electricity or natural gas. Natural-gas engines may be more expensive to install, but they generally operate at considerably less cost: Gas engines can be put under service contracts that assure a life expectancy comparable to that of electric motors. Gas engines also provide heat energy that can be used for space heating through a heat-recovery system.

The brine pump is the heart of the refrigeration process. When it breaks down, everything stops and the ice surface is at the mercy of the sun and weather during the period of repair. Some brine pumps have quick-repair features that can shorten the time the system is out of operation. For all practical purposes, the breakdown time can be eliminated by building two brine pumps into the system. With this arrangement, one pump will give stand-by service in case the other fails.

Heat removed from the ice is eliminated in the refrigeration process by the condenser. The condenser may use either cold water or the evaporation principle to accomplish heat rejection. An evaporating condenser costs more to buy, but if water is an item of expense, it will be cheaper to operate. Many competent rink designers insist on evaporative condensers where city water alone must be used for cooling. The refrigerant, which has absorbed heat in cooling the brine, is cooled in this cycle of operation by circulating through exposed coils. When the air temperature alone cannot cool the refrigerant to the proper level, water is sprayed on the coils and then fans blow air over the wet coils to cause evaporation.

Three types of refrigerants are available: ammonia, Freon 12, and Freon 22. Although operation with ammonia has been efficient, it is both toxic and explosive, and for these reasons, the trend has been toward the use of Freon, which is neither toxic nor explosive. There is little difference in the initial cost of refrigeration machinery designed for either ammonia or Freon gas, although the compressors for ammonia are much larger than those for Freon. The cost of the refrigerant does differ, however, with Freon costing about five times as much as ammonia. This cost is equalized, since an ammonia system will use nearly five times the refrigerant used by a Freon system. Since Freon is odorless, leaks in the system may go undetected, and expensive replacement of refrigerant becomes necessary. This is not the case with ammonia. However, safety is an overriding factor that dictates the preference of Freon for ice-rink refrigeration. There are, of course, situations where ammonia should be recommended, but local laws should always be consulted before using ammonia.

Calcium chloride brine is used in most ice-rink refrigeration systems. It is not expensive, but it is highly corrosive and must be closely watched. It is possible to purchase salt (for brine) that contains a chromate to act as a rust inhibitor. This inhibitor does not last long, however, and additional chromate must be added from time to time. Although corrosion is reduced by the chromate, it is not eliminated. There is a growing trend toward the use of ethylene-glycol or metholene alcohol as a brine. Once stabilized, these brines usually require no further attention.

There are several exceptions to the standard refrigeration system, one of them being the direct expansion system. It dispenses with the heat exchanger and brine pump, distributing the refrigerant directly to the coils in the rink deck (see Figure 5).

The following types of floor construction are used in building artificial-ice rinks:

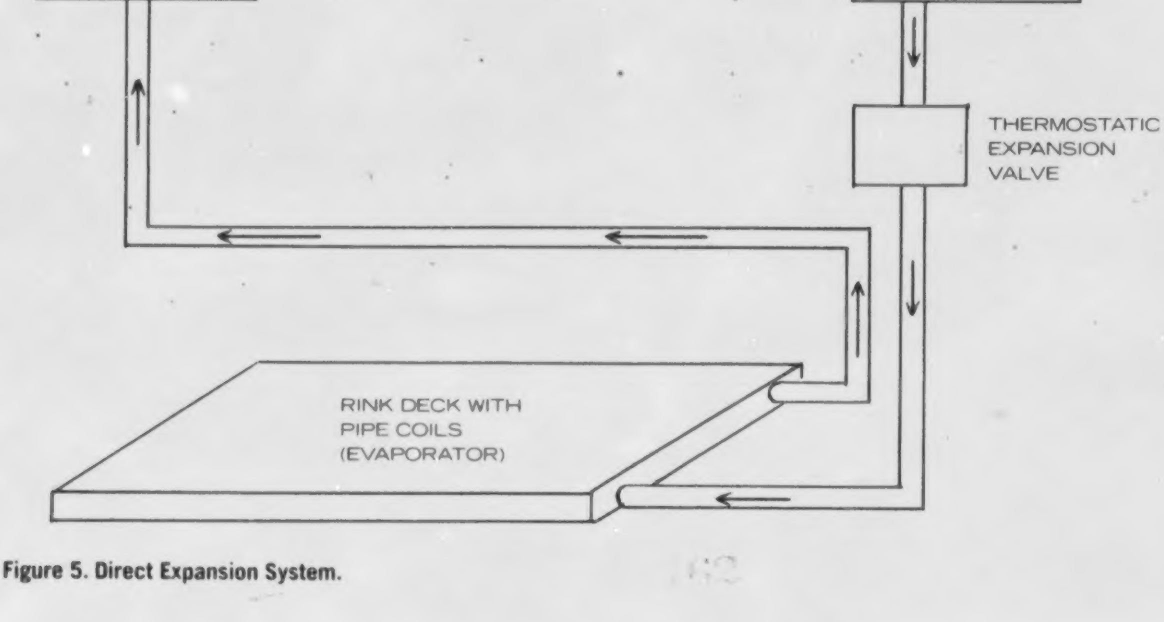

Figure 5. Direct Expansion System.

- Steel piping in post-stressed concrete
- Steel piping in reinforced concrete
- Open steel piping (or in sand)
- Open plastic piping (or in sand).

These choices are listed in the order of their cost, the most expensive first. In addition, aluminum-finned tubes have recently made their appearances as piping for rink floors. The newly developed construction of steel piping in uniform post-stressed concrete floors is the most costly of the choices listed but the least likely to develop cracks or heaving. Heaving is the upward deflection of the rink deck caused by freezing of water in the gravel and soil fill underneath. It is reliably calculated that a post-stressed floor can endure, if necessary, at least twice as much frost heaving as conventional reinforced concrete floors.

Plastic is lightweight and easy to handle, especially in portable and take-up installations. However, plastic acts as an insulator and does not transfer heat from ice to brine as rapidly as steel does. Plastic is cheaper than steel but may not last as long. The main preference for steel appears to be the efficiency in maintaining ice temperatures.

The floor pipes are connected to headers attached to the supply and return lines. There are two basic header designs, each with several variations. One system employs a header at each side of the rink, or at each end, with the floor piping joined to these headers at each end. The advantage of this design is that ideal uniformity of ice can be maintained. The disadvantages are that it is the most expensive design, and temperature expansion variables can be a problem. In the second and more common design, both headers are at the same side or end, and the grid surface is made up of hairpin pairs of pipes.

Construction practices call for good drainage around foundation footings to cut off ground-water seepage into the floor area. The installation of a slip joint consisting of two or more dry, lubricated membranes between the grid and foundation slabs of concrete is essential. The concrete slab encasing the grids should be poured in a continuous operation, which will permit the grid slab to contract or expand as a unit rather than in sections. The return header should be slightly elevated so that there can be no trapped air in the cross pipes. To eliminate brine leakage caused by faulty assembly, the floor should be pressure-tested after construction and, if it is a take-up rink, after assembly.

Other considerations. Although most outdoor rinks have no cover, a variety of covers are available. A netting can provide a sunshade on bright days. It is drawn across the rink on high cables as a curtain, greatly weakening the melting effect of sunlight. An inflated bubble of fabric has also been used as a rink enclosure, kept inflated by a low interior pressure supplied by fans. Permanent covers have been constructed of steel, concrete, and wood, and there is now a trend toward using prefabricated metal buildings. All these covers reduce power costs and snow-removal expense. A variety of permanent buildings have also been used to house ice-skating studios, general skating rinks, and ice arenas.

Whether the skating area is open or enclosed, a warming room or skate-changing room is necessary. Consideration may be given to the use of existing park buildings or portable buildings. The warming house should contain benches and perhaps checking facilities for shoes. Adjoining the warming room in many rinks is a concession serving hot and cold drinks, sandwiches, candy, and popcorn. Besides providing a service required by the public, a concession's profit is often considerable. A first-aid room provides for the efficient handling of skating falls and injuries. Skate rental is a service that is not only profitable but also highly desirable in the campaign to keep skaters on the ice as they grow older.

Choices and problems will not cease to exist with the construction of the rink. They will continue in the programming and in the assuring of protection and pleasure to those using the facility. To get the fullest use out of as expensive and complex a facility as an ice rink, it will be necessary to program its use. General skating sessions during which skaters just go round and round is not enough. Interesting and challenging situations are needed to attract older skaters and keep them on the ice. The social side of ice skating must be exploited to maintain sufficient enjoyment to keep people skating. The job is just beginning when the rink has been completed.

Natural-Ice Rinks

Preseason preparations. If the rink is to be laid on the ground, sufficient moisture will be needed to provide ground frost. Water the area if a dry condition prevails. If a temporary dike is needed, it should be made in the fall so that settling can take place. If the rink is to be made on a concrete surface such as a tennis court, all drains should be sealed. Hoses, hydrants, nozzles, and scraping and snow-removal equipment should all be checked prior to rink-building time. Ponds, streams, and lakes should be considered as possible ice-skating sites and necessary safety precautions taken in regard to ice thickness.

Construction procedures. Site characteristics control in part the procedures necessary to build natural-ice rinks. If the ground is level and water can be contained by means of grades or dikes, flooding is possible. If these conditions do not prevail, it is necessary to spray the water into the rink area. Flooding is faster and more economical, while spraying provides ice when flooding fails. Either process calls for temperatures of 20 degrees or colder, and the colder the temperature the faster an ice rink can be made.

In either method, the temperature of the water must be taken into account. Water coming from the main contains sufficient heat to melt ground frost. Therefore, it is advisable to flood at a rate slow enough to permit water to chill before the frost melting point is reached. If spraying is necessary, the hose should be fitted with a spray nozzle and the water should be directed high in the air. Since lower temperatures occur in the evening, many communities do their flooding or spraying at night or in the early morning hours to obtain a faster build-up of ice. Care should be taken to drain the hose immediately after spraying to prevent the hose from freezing.

The rate of build-up in a spray operation may be accelerated by diking the base ice with snow to reduce runoff. Care should be taken not to melt into the snowbank with too much water at one time, or shell ice will result. Shell ice occurs when water seeps away after the surface is frozen over. Seepage can occur if the ground frost melts, a leak in the dike develops, or water melts away a part of the snowbank. Shell ice will remain a problem until it is removed. If air pockets develop in the process of flooding, they should be punctured and filled with water before flooding is completed. It is very important that more than one person be present when making ice, so that help is available in case of injury.

Natural-ice rinks can be created on tennis courts or other hard-surface areas, although costly additional construction is necessary. Some types of tennis courts do not hold up well if water is frozen on their surfaces.

Liner rinks. In many areas of the country, the traditional method of building natural-ice rinks is almost impossible because of constant freezing and thawing. In order to have success with the usual natural rink, temperatures must remain near or below freezing.

Many communities have 30 or 40 days of appropriate skating weather, but fluctuating temperatures cause the ice to melt and the ground to thaw. Under these conditions, the natural-ice rink is impractical, but the liner rink is a possibility.

A plastic liner (polyethylene) is used to prevent water seepage and to waterproof the floor and sides of the rink. This material can be obtained in large sections—100 by 100 feet, 200 by 200 feet, and variations of these sizes. A framework to contain the liner should be constructed on flat ground or possibly around the edge of a hard-surface area (see Figure 6). Sand is placed on the inside for a distance of 10 to 12 inches from the bottoms of the boards and shaped to form a cove. The liner is placed on the inside of the framework and up over the top. A cap of one-by-fours, which will extend below the ice on the inside, is necessary around the structure in order to prevent skates from puncturing the liner. The rink is then filled to the proper level with water.

Fencing and a ramp and rail are recommended. Temporary lights and music will add to skating pleasure.

Resurfacing. Once the ice surface is used for ice skating it should be resurfaced when needed. This can be accomplished by scraping away or sweeping the cuttings and spraying a light coat of water over the ice. If some cuttings are left after scraping, a little additional water should melt them and a good skating surface will result.

Safe Practices. Safety regulations should be posted. Rules should prescribe the direction of skating and conduct of skaters and forbid games of a rough nature, such as tag, as well as objects on the ice, such as sleds and other coasting devices. Hockey sticks and pucks should also be banned during general skating sessions and times when small children are using the facility.

The thickness of ice is critical on ponds, streams, and lakes used for ice skating, and proper safety precautions should be taken to prevent accidents. Warning signs, barriers, and the dissemination of warnings through public communications media are desirable.

Hockey

Ice rinks may have a sport function as well as providing a recreational service. If ice hockey is to be part of the rink's activity schedule, goals will be needed and a four-foot high solid fence, called the dasher, will have to be installed to enclose an area as near 85 by 185 feet as possible. Dasher boards are heavily reinforced to stand the shock of players being pushed against them and are lined on the rink side with either wood or plastic. There is normally a chain link or clear plastic barrier another four to six feet on top of the dashers to enable spectators to view games safely. The dasher-board enclosure should have round corners, because square corners present a hazard. A kick board six or eight inches wide is fastened at the base of the dasher boards and is replaced as often as necessary. Because dasher boards will reflect sunlight and cause melting of the ice, they should be painted a dark color. However, it is difficult to follow the puck if the dasher boards are too dark, so a shade of grey is recommended. If the hockey rink is indoors, the dasher boards can be painted a light color without causing a melting problem. If night hockey is anticipated, adequate lighting to ensure seeing the fast-moving puck is essential for safety reasons. (See Figure 7.)

Colored hockey lines on an outdoor rink create a melting problem on sunny days, which can be reduced by using vegetable dye in a water solution. The Ice Skating Institute of America has published a detailed technical paper on marking ice-hockey rinks and has developed a routing head for cutting lines in the ice.

Racing may be made a part of the natural-ice rink program by laying out a track of four, six, eight, or more laps to the mile. The track boundaries can be designated by drilling holes and inserting flags on short staffs. Many communities hold annual racing derbies for general participation. In some instances, skating clubs develop and the competition intensifies. As the quality of competition improves, so must the quality of the facility. Such refinements are explained in manuals of the Amateur Skating Union, an affiliate of the Amateur Athletic Union.

Curling

Curling is a popular ice sport on both natural and artificial ice. Sponsored by clubs and leagues, it is played with a hand-thrown 35- to 38-pound stone. There are four members on a team, with two stones. The object is to place one's stone nearest the mark. For a diagram of a rink laid out for curling, see Figure 8.

Performing Arts Areas

In the past few years there has been increased demand for suitable facilities, both indoor and outdoor, for operas, plays, band and orchestral concerts, pageants, festivals, holiday programs, and civic celebrations. When performed outdoors, such activities usually require a stage or band shell with adjoining amphitheater capable of accommodating large numbers of spectators.

Selection of the proper site for an outdoor theater is of primary importance. It should have good acoustic properties and be located in a quiet place away from the noise of traffic or of groups at play. A natural bowl or depression on a hillside with a slope of 10 to 20 degrees, preferably bordered by slopes or densely wooded areas, provides a fine location.

At some theaters, people sit on the turf of the slope comprising the amphitheater. At others, permanent seats are installed. Terraces with a turf surface are not recommended because they are too difficult to maintain. Sufficient level space should be provided at the rear of the seating area for the circulation of spectators, and aisles should be wide enough to facilitate the seating of large numbers in a short period of time. Public comfort stations and refreshment fa-

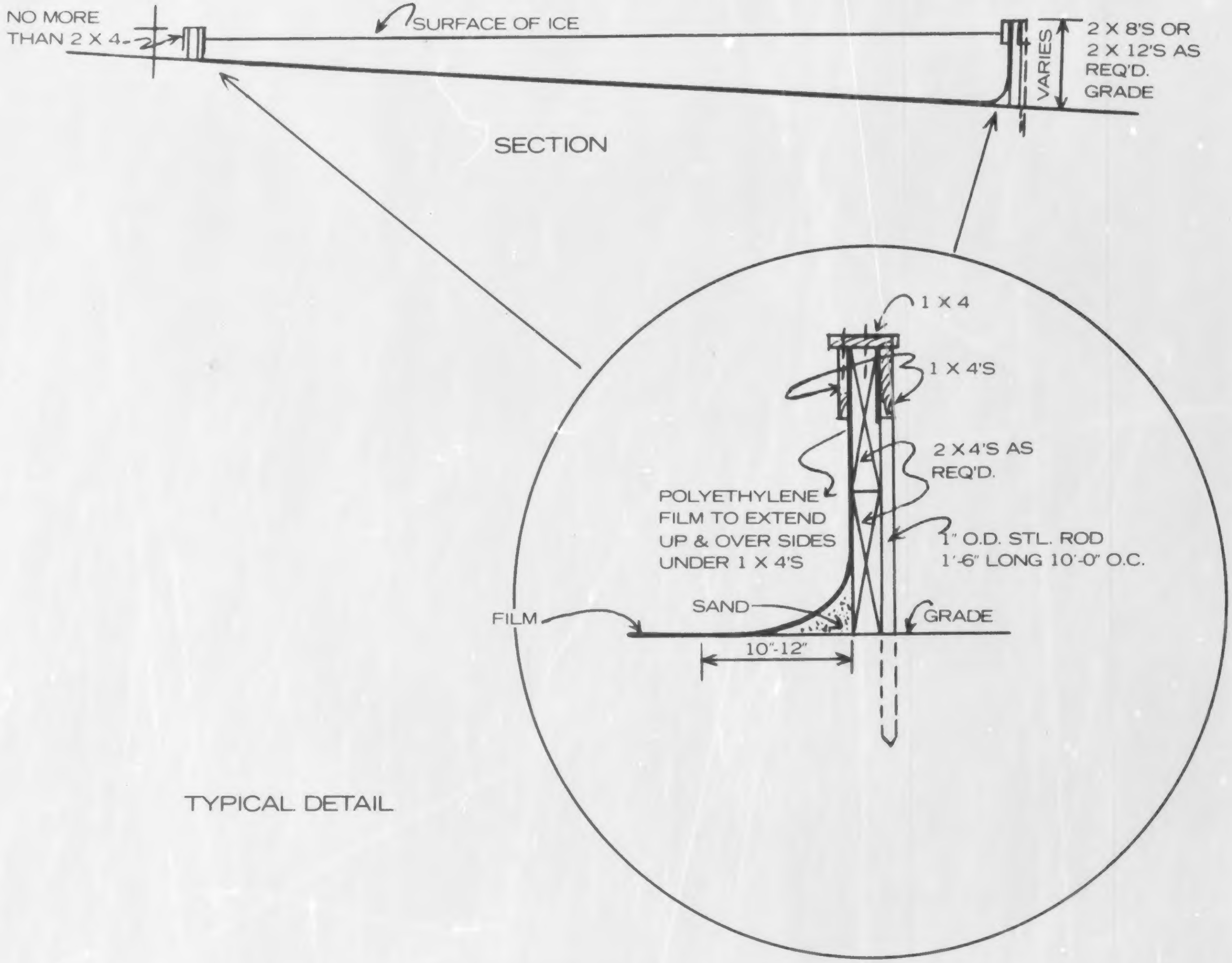
NO MORE THAN 2 X 4
SURFACE OF ICE
VARIES
2 X 8'S OR 2 X 12'S AS REQ'D.
GRADE
SECTION
1 X 4
1 X 4'S
2 X 4'S AS REQ'D.
POLYETHYLENE FILM TO EXTEND UP & OVER SIDES UNDER 1 X 4'S
1" O.D. STL. ROD 1'-6" LONG 10'-0" O.C.
FILM
SAND
GRADE
10"-12"
TYPICAL DETAIL

Figure 6. Liner Natural Skating Rink.

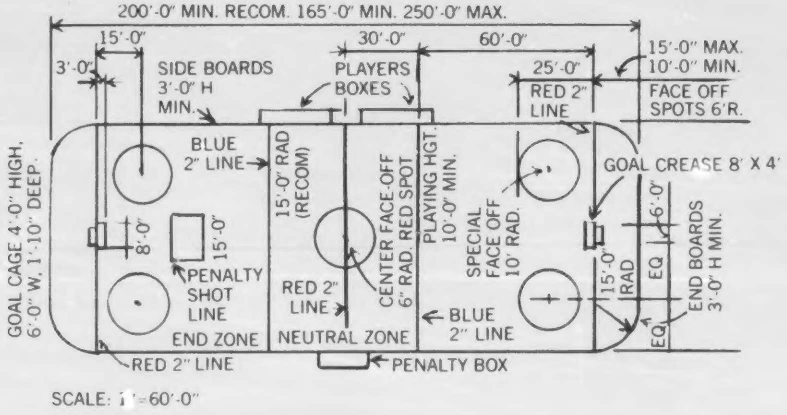
200'-0" MIN. RECOM. 165'-0" MIN. 250'-0" MAX.
15'-0"
30'-0"
60'-0"
3'-0"
SIDE BOARDS 3'-0" H MIN.
PLAYERS BOXES
25'-0"
RED 2" LINE
15'-0" MAX. 10'-0" MIN.
FACE OFF SPOTS 6'R.
BLUE 2" LINE
15'-0" RAD (RECOM)
CENTER FACE-OFF 6" RAD. RED SPOT
PLAYING HGT. 10'-0" MIN.
GOAL CREASE 8' X 4'
GOAL CAGE 4'-0" HIGH, 6'-0" W, 1'-10" DEEP.
8'-0"
15'-0"
PENALTY SHOT LINE
RED 2" LINE
SPECIAL FACE OFF 10' RAD.
6'-0"
15'-0" RAD
EQ
EQ
END BOARDS 3'-0" H MIN.
BLUE 2" LINE
END ZONE
NEUTRAL ZONE
RED 2" LINE
PENALTY BOX
SCALE: 1"=60'-0"

Figure 7. Ice Hockey.

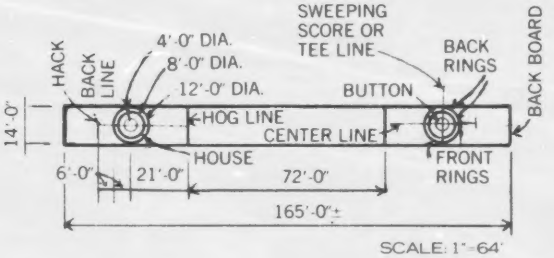
SWEEPING SCORE OR TEE LINE
HACK
BACK LINE
4'-0" DIA.
8'-0" DIA.
12'-0" DIA.
BACK RINGS
BACK BOARD
BUTTON
14'-0"
HOG LINE
CENTER LINE
HOUSE
FRONT RINGS
6'-0"
21'-0"
72'-0"
165'-0"±
SCALE: 1"=64'

Figure 8. Curling.

cilities are usually provided near the entrance to the amphitheater. Provision for the nearby parking of automobiles is essential, but parking areas must be located where noises and car lights do not disturb the theater.

The dimensions of the stage are determined by the proposed uses, but rarely should a stage be less than 50 feet in width or 30 feet in depth. The rear of the stage may be a wall or high hedge, or even a planting of trees, and the wings may be formed by natural plant materials. The band or music shell, however, is more satisfactory for projecting voices and sounds free from echoes and interference. A vertical rear wall with inclined ceiling is not only the simplest and most economical to construct, but affords excellent acoustic qualities.

The band shell usually contains dressing rooms, toilets, storage space, and control centers for amplifying and lighting equipment, although sometimes these facilities are provided in separate structures near the back of the stage. An orchestra pit is generally located between the auditorium and the stage.

Mobile stage units with self-contained lighting and acoustic systems are becoming very popular today because they can be used in many parks instead of restricting programs to one permanent location. Equipped to serve as a band shell, stage, puppet theater, or platform for other performing arts, these mobile units can bring productions to new audiences never exposed to such activities. Excellent units can be obtained at a cost less than that required for a permanent band shell.

Play Apparatus Areas

Play equipment can be significant in the mental and physical development of children, and the design of apparatus areas should not be taken lightly. The Motor Performance and Play Research Laboratory at the University of Illinois states that the essential ingredient for a playground is that it elicit new responses from the child as he plays and that these responses increase in complexity as his play proceeds.

Playground equipment includes multipurpose, movable elements as well as the more or less permanently placed equipment designed for physical fitness and creative play. Playgrounds should contain equipment that will give opportunities for experimentation in movement and for development of the large muscles. Equipment is also needed that will give opportunities for physical coordination—climbing, hanging, balancing, pushing, and pulling.

Equipment for the young child should be low enough to be safe, versatile enough to meet a short interest span, and geared to his coordination abilities. It is especially important that the equipment area for younger children be located near the school or service building.

The older child requires larger and stronger equipment to test his skill and strength and to challenge him in developing new skills. All outdoor equipment should be constructed of heavy-duty materials.

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*Ellis, M. J. *The Rational Design of Playgrounds. Urbana:* Motor Performance and Play Research Laboratory, University of Illinois.

It is important to orient and organize equipment areas so as to separate the various age groups, both for reasons of safety and for ease of supervision and use. Orientation of game equipment in relation to the sun is also important.

Some of the play equipment should challenge the imagination of the child and should present an element of unpredictability. There is no need for equipment to be dull, drab, and unattractive. The use of gaily colored equipment is recommended. Sculptured forms of animals and natural objects are innovations that are now widely used. Materials for play equipment—in addition to the conventional metals, wood, and concrete—now include plastics, fiberglass, and bronze. Colors impregnated in plastics and concrete prevent the necessity of frequent painting.

If possible, play apparatus should be changed periodically to provide children with new opportunities to explore and use the environment. Play apparatus areas throughout a community should be different from one another and not stereotyped duplicates.

The surface treatment under apparatus equipment is very important. Various types of materials that have been used are sand, wood chips, tanbark, asphalt, and a variety of synthetic surfaces. The use of asphalt covered with a synthetic material has been gaining in popularity because of the safety and aesthetic aspects even though the initial cost is higher. A level surface is always maintained with this treatment, which is safer for the children at play. Water puddles do not appear under swings, and less maintenance is required for this surface.

When such materials as wood chips, sand, or peanut hulls are used under apparatus, care must be taken to provide proper drainage. It is recommended that a pit three to four feet deep be dug under the apparatus and filled with gravel and/or sand to provide the drainage. The surface material should then be spread over the pit to a depth of 8 to 10 inches. Sand is not recommended for use under apparatus because it gets dirty and it has a tendency to absorb broken pieces of glass and other materials, which can result in bad accidents.

A playground concept that has been very successful in Europe and is being tried recently in the United States is the adventure playground. A true adventure playground is an area filled with brick, lumber, dirt, scrap metal, and other such materials. In this playground the children are free to build and to change their environment. Cooperative building projects can last for many weeks in this setting.

Outdoor Shooting Areas

RIFLERY

The advisability of constructing an outdoor rifle range at a school, college, or recreational site will depend on several factors: (a) the terrain and location of the parcels of land; (b) the availability of nearby outdoor ranges owned by sportsmen's clubs, military organizations, and other groups, which might be used for instruction and recreational shooting; and (c) the location of indoor ranges.

If an outdoor range is developed, the target area should be protected, preferably by natural embankments. If the land is level, adequate banks of soil can be constructed that will reinforce the other types of backstops used. It is always desirable to have a good-sized area with plenty of unused space back of the target. A 50-foot range is sufficient for most instructional and recreational programs, since the .22-caliber rifle will be used in most instances. (See Figure 9).

When considering a range, it is advisable to consult the National Rifle Association (NRA) and, if possible, have the site inspected by a member of the NRA staff. Detailed information on specifications can be obtained from the National Rifle Association, 1600 Rhode Island Avenue, N.W., Washington, D.C. 20036.

TRAP AND SKEET

Shotgun shooting and games like skeet are becoming increasingly popular. There may not be adequate facilities for trap and skeet in nearby gun clubs, police ranges, and military establishments. In such circumstances, an open area can be used for skeet by utilizing hand traps.

If the adjacent property, such as open fields, woods, or swamps, is not being used during the time of shooting, skeet can be conducted safely under the supervision of a qualified instructor. Figure 10 shows layouts for trap and skeet fields. The National Rifle Association has detailed information on shotgun shooting and facilities.

ARCHERY

This sport has appeal to a sizable group in most communities. It is important to provide sufficient space in order to ensure the safety and enjoyment of the participants.

The range should provide shooting distances of 100, 80, 60, 50, 40, and 30 yards. For junior use, target ranges can be from 10 to 50 yards. Targets are 48 inches wide and should be at least 15 feet apart. Generally, the target line is fixed and varying shooting lines are used. The side boundaries should extend 10 yards beyond each end of the range.

In the interest of safety, additional space should be provided beyond the target, free from stones and other substances that might cause the breakage of arrows falling wide of their mark. This space may be protected by an earth bunker or bales of hay and straw piled up to the top of the target. (See Figure 11).

An archery range should be fairly flat. Orientation should be north and south so that archers will not be facing the sun.

A fence enclosure is desirable but not essential. The public should be controlled in some manner, however, so that they do not walk through the range.

Storage sheds for butts and other equipment are sometimes a part of the archery range. Some storage rooms have been placed within the earth bunker behind the targets.

So that the same facility may be used by the disabled, it is desirable to design a four-foot width, ground-level hard-surface walk for wheelchair use along the shooting lines. Another walk could extend to the target line (preferably down the center) and perhaps another walkway behind the targets to provide access for extracting arrows. Such walks reduce interference from inclement weather, increase the use of the range, and reduce maintenance costs.

Field archery is a simulation of actual shooting conditions in the field. Up to 28 targets are used on the field course. The site selected for such a course should be heavily wooded and have rolling terrain. It should be fairly well isolated or in an area that can be controlled so that the general public will not walk through it. Targets should be mounted on built-up banks or on the side of a hill. Each target has various pins (shooting positions). The farthest target is 80 yards and the nearest is 30. The target should simulate either animals or concentric circles. The size is dependent upon the distance

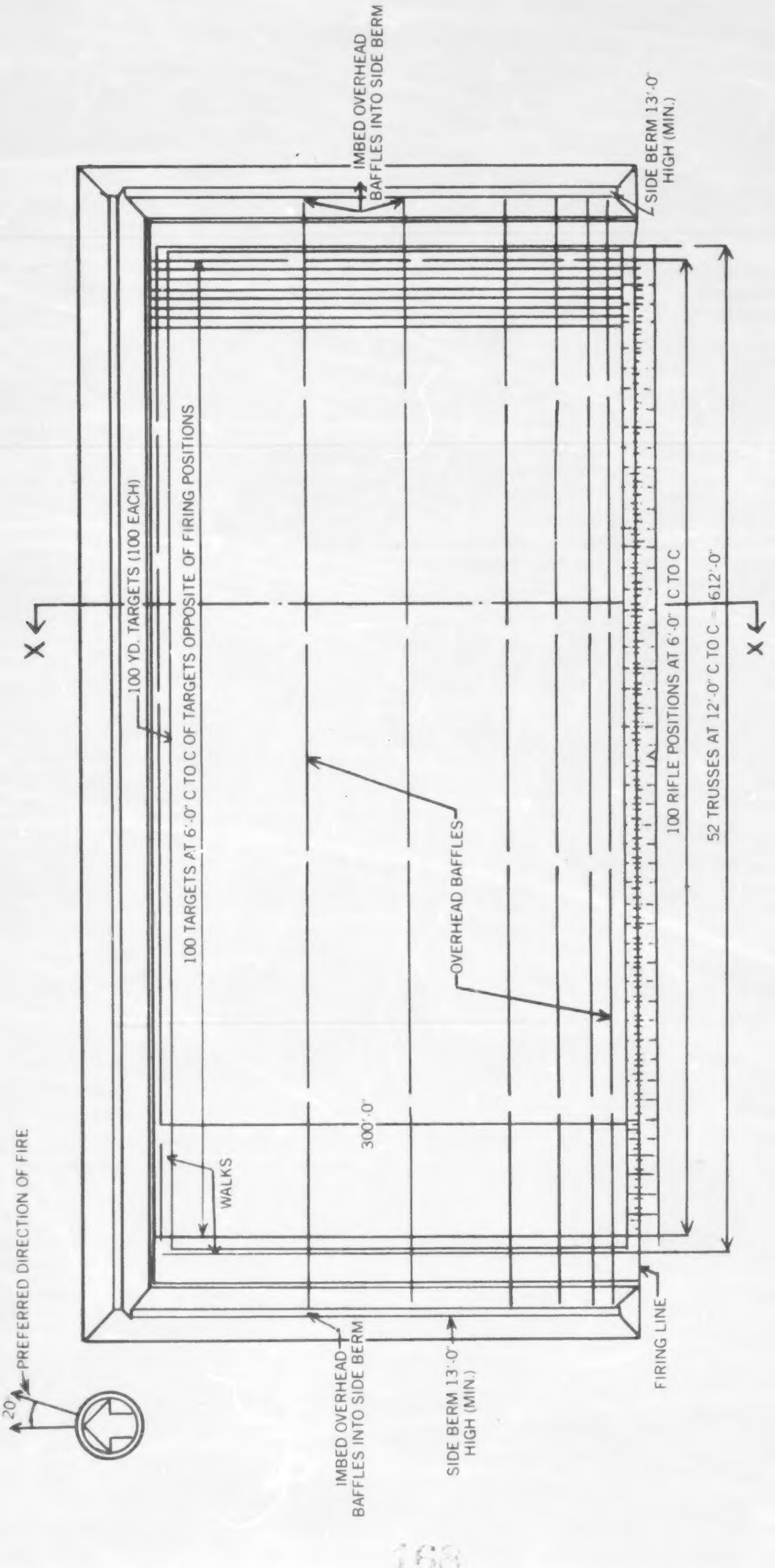
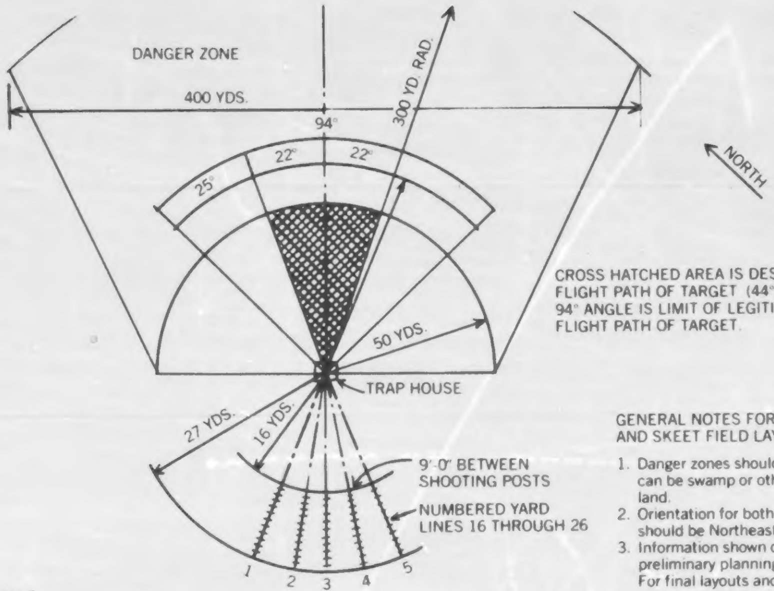

20°
PREFERRED DIRECTION OF FIRE
IMBED OVERHEAD BAFFLES INTO SIDE BERM
SIDE BERM 13'-0" HIGH (MIN.)
FIRING LINE
WALKS
300'-0"
100 YD. TARGETS (100 EACH)
100 TARGETS AT 6'-0" C TO C OF TARGETS OPPOSITE OF FIRING POSITIONS
OVERHEAD BAFFLES
X
X
100 RIFLE POSITIONS AT 6'-0" C TO C
52 TRUSSES AT 12'-0" C TO C = 612'-0"
IMBED OVERHEAD BAFFLES INTO SIDE BERM
SIDE BERM 13'-0" HIGH (MIN.)

Figure 9. Smallbore Rifle and Carbine Range

NOTES:
1. Trap Field can be superimposed over Skeet Field.
2. Consult manufacturers for trap house details.

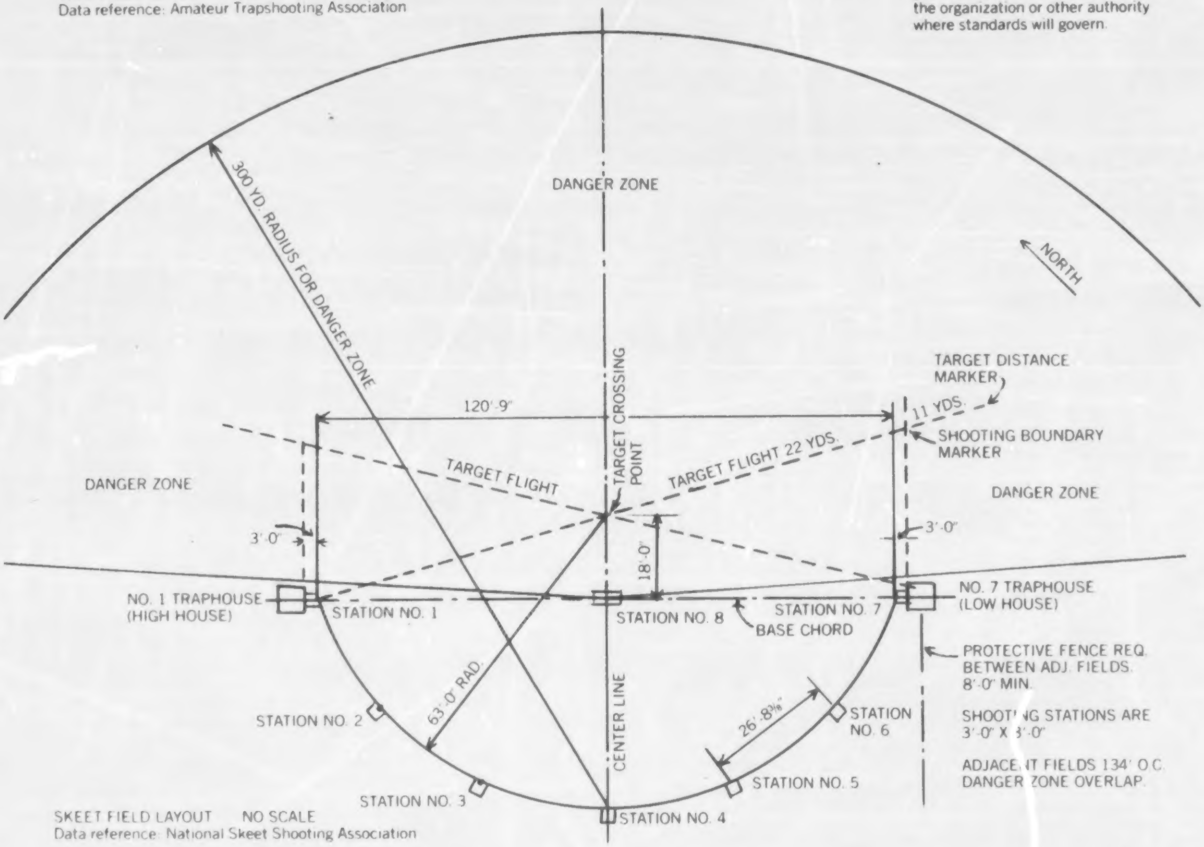

DANGER ZONE
400 YDS.
300 YD. RAD.
94°
25°
22°
22°
NORTH
50 YDS.
TRAP HOUSE
27 YDS.
16 YDS.
9'-0" BETWEEN SHOOTING POSTS
NUMBERED YARD LINES 16 THROUGH 26
1
2
3
4
5

CROSS HATCHED AREA IS DESIRABLE FLIGHT PATH OF TARGET (44°). 94° ANGLE IS LIMIT OF LEGITIMATE FLIGHT PATH OF TARGET.

TRAP FIELD LAYOUT NO SCALE
Data reference: Amateur Trapshooting Association

GENERAL NOTES FOR TRAP FIELD AND SKEET FIELD LAYOUTS

1. Danger zones should be cleared, but can be swamp or other types of wasteland.
2. Orientation for both types of fields should be Northeast, as indicated.
3. Information shown on this page is for preliminary planning and design only. For final layouts and design investigate current rules and regulations of the organization or other authority where standards will govern.


DANGER ZONE
300 YD. RADIUS FOR DANGER ZONE
NORTH
TARGET DISTANCE MARKER
11 YDS.
120'-9"
TARGET CROSSING POINT
TARGET FLIGHT
TARGET FLIGHT 22 YDS.
SHOOTING BOUNDARY MARKER
DANGER ZONE
DANGER ZONE
3'-0"
3'-0"
18'-0"
NO. 1 TRAPHOUSE (HIGH HOUSE)
STATION NO. 1
STATION NO. 8
STATION NO. 7
BASE CHORD
NO. 7 TRAPHOUSE (LOW HOUSE)
63'-0" RAD.
CENTER LINE
26'-8¾"
STATION NO. 2
STATION NO. 3
STATION NO. 4
STATION NO. 5
STATION NO. 6

PROTECTIVE FENCE REQ. BETWEEN ADJ. FIELDS. 8'-0" MIN.

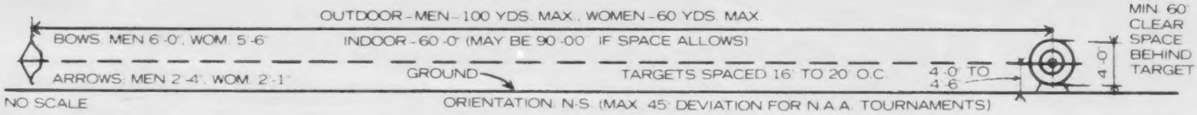
SHOOTING STATIONS ARE 3'-0" X 3'-0"

ADJACENT FIELDS 134' O.C. DANGER ZONE OVERLAP.

SKEET FIELD LAYOUT NO SCALE
Data reference: National Skeet Shooting Association

Charles F. D. Egbert, AIA; Architect; Washington, D. C.

Figure 10. Trap and Skeet Shooting.


OUTDOOR - MEN - 100 YDS. MAX., WOMEN - 60 YDS. MAX.
BOWS: MEN 6'-0", WOM. 5'-6"
INDOOR - 60'-0" (MAY BE 90'-00" IF SPACE ALLOWS)
ARROWS: MEN 2'-4", WOM. 2'-1"
GROUND
TARGETS SPACED 16' TO 20' O.C.
4'-0" TO 4'-6"
4'-0"
MIN. 60' CLEAR SPACE BEHIND TARGET
NO SCALE
ORIENTATION: N-S (MAX. 45° DEVIATION FOR N.A.A. TOURNAMENTS)

SOURCE: NATIONAL ARCHERY ASSOCIATION

Figure 11. Archery.

from the target. The scoring is similar to that for golf—the score is totaled for each target, the grand total giving the score for the complete round.

Clout shooting requires a variation in target size and arrangement. The target face is marked on the ground with white lines. The size of the target is enlarged so that one inch on a regular 48-inch target would equal 12 inches on the ground. The center of the bull's-eye must be indicated by a single-color flag. The range for men is 180 yards; for women and juniors, 120 yards.

The field dimensions for flight shooting are approximately 200 by 600 yards. The field should be roped off on all sides except that from which the archers shoot. A distance of not less than 10 yards behind the shooting line is reserved for the flight shooting space. Officially, the flight must be from a series of colored or numbered pegs set in the ground, usually about six feet apart.

Snow Sports

SKI COURSES

Skiing has become exceedingly popular in the past few years, and it is, indeed, a fine outdoor sport. If climatic conditions are suitable and desirable topographic features available, a school or a park and recreation department should look into the possibility of developing the facilities needed to foster this sport.

The provision of skiing in a school or public recreational system should be approached from an instructional standpoint, the theory being to give participants some basic instruction in the sport so they can enjoy it as a leisure-time activity in the resort areas that have more ideal facilities. If the park system contains ideal skiing hills with plenty of room, regular ski courses may be developed. Some of the basic facilities required for skiing instruction are proper topographical features; a headquarters building to be used for rental of equipment, a refractory, and similar purposes; a ski tow; and various slopes for instructional purposes.

Normally, the series of classes is broken into three units—beginners, advanced, and expert. It is the opinion of ski instructors that the beginners' ski class is by far the most important for recreational skiing.

Basic instruction in skiing may be conducted in classes not exceeding 25 to 30 beginners. For this group, a gentle and short slope with a relatively large flat run-out area is desirable because it permits a beginner to have complete control of himself and allows him to gain confidence in the use of his skis. In the advanced group classes are much smaller, and in the expert group, instruction becomes almost individual. For each successive group, hills become longer and a little steeper.

Beginners' Classes

The following criteria are recommended for the selection of facilities for beginners' classes:

- Flat-top hill area, 50 square feet per skier, 25 skiers per class
- Slope about 75 feet to 100 feet long, drop in grade of 15 feet, or 4:1 ratio
- Starting line at top of slope, 100 feet wide
- Run-out at bottom of slope either flat or uphill
- Slope facing east or northeast
- Instructional area free of stones, woods, and other impediments
- Protective cover, such as trees or brush, around the area.

Advanced Classes

The following criteria are suggested for the selection of facilities for advanced classes:

- Top of hill about the same as for beginners
- Slope is most important: ratio about 3:1 and length 100 to 150 feet
- Width of hill or slope, minimum of 150 feet because of speed and space required for turning movements.

Expert Classes

The following criteria are recommended for the selection of facilities for expert classes:

- Either the same hill as advanced classes or, preferably, a longer and steeper hill
- Enough downhill length to permit a minimum of three turning movements—for example, 250 feet on a 3:1 slope
- Greater width than that of slope for advanced classes.

COASTING, SLEIGHING, AND TOBOGANNING

Often a community has a hill or hills suitable for coasting, which become meccas for children with sleds, toboggans, and other coasting devices after every snowfall. In the absence of a natural coasting hill, some park and public works departments have built such a facility. These hills are usually located in a park safely guarded from the hazards of street traffic.

In developing local coasting areas, care should be taken to incorporate adequate safety features. Plenty of room should be provided between sled runs, and up traffic should be isolated from the down traffic. The area should be as free as possible from hazards, such as nearby trees, grills, benches, or other park paraphernalia.

Communities with an extensive response to coasting or skiing may want to counter adverse weather with the use of artificial-snow equipment or improve the activity with a ski lift.

Sleighing is a recreational activity that uses sleighs drawn by horses or oxen. It can take place on roads, trails, or paths.

Tobogganing is a thrilling sport requiring designed space. Occasionally, natural slopes are used if they are free from obstructions and have a long bottom run-off. The common practice is to choose a hillside with a reasonably steep and even grade. A chute is constructed off a wooden trough. It can be permanent or built in sections.

AREAS FOR OUTDOOR EDUCATION AND RECREATION

Future historians will surely note the decades following World War II as a time when the outdoors came into prominence as a significant place for both education and recreation. The unprecedented growth of all types of outdoor activities necessitating land areas and facilities can be expected to continue apace. A growing awareness on the part of educational and recreational leaders that the present generation and those to come are far removed from the land and the rural life of their forebears has caused much interest and concern in the development of outdoor education programs. Because school-age children and many adults know little about the outdoors, programs and facilities must be designed to educate them in, about, and for the outdoors. An ecological approach to outdoor education has both recreational and educational implications.

The Elementary and Secondary Education Act of 1965 and the Environmental Education Act of 1970 are examples of federal statutes that have helped facilitate programs in outdoor education and outdoor recreation. Most states are currently developing their own plans for environmental education. Educational and recreational organizations have accelerated their efforts in developing programs to meet the urgent need for educating the public concerning the protection and use of our natural resources. The Outdoor Education Project of the American Association for Health, Physical Education, and Recreation is an illustration of a nationwide educational effort in leadership preparation for outdoor education and in providing services and materials to stimulate the development of more effective programs.

Outdoor education is a term that refers to learning activities in and for the outdoors. Such activities can be provided in the curriculums of schools, colleges, and universities as well as in the programs of recreational, camping, and community agencies. Outdoor education has been broadly described as follows:

> Outdoor education means learning in and for the outdoors. It is a means of curriculum extension and enrichment through outdoor experiences. It is not a separate discipline with prescribed objectives, like science and mathematics; it is simply a learning climate offering opportunities for direct laboratory experiences in identifying and resolving real-life problems, for acquiring skills with which to enjoy a lifetime of creative living, for building concepts and developing concern about man and his natural environment, and for getting us back in touch with those aspects of living where our roots were once firm and deep.

This concept of outdoor education brings it within reach of every school, college, and educational agency in the land. Most teachers and youth leaders will find outdoor resources which they can use to enhance learning and to provide opportunities for acquiring knowledge and skills necessary for wholesome outdoor pursuits.

Outdoor education programs may have a variety of patterns and may be conducted in a variety of outdoor settings, such as school sites, camps, field campuses, parks, recreational areas, sanctuaries, museums, lakes, ponds, streams, forests, farms, or other land areas and facilities. Consequently, in considering facilities, much attention must be given to the types of outdoor programs that are now developing. The following principles are important in this connection:

- Maximum use should be made of the unique qualities of the natural environment without destroying its integrity.
- The areas and facilities should be designed to serve the needs of all age groups on a year-round basis.
- The program and facilities should supplement and enrich the community's educational and recreational resources.
- The program should determine the structure and the site treatment, but planners must be ever mindful of the impact on the natural environment.

Outdoor education, when applied to schools and colleges, is a means of curriculum enrichment involving the use of the outdoors as a laboratory and the teaching of skills, appreciations, and attitudes for the wise use of the outdoors and natural resources. Consequently, outdoor education facilities should serve the entire educational program and should be designed to supplement the other resources of the school plant and the "community campus." All community agencies concerned with education and recreation should be involved in the planning of adequate outdoor resources.

Outdoor education and outdoor recreation encompass a great variety of activities, many of which can be conducted on a single, large tract of land. With careful planning, facilities and site can have multiple uses. It is recognized that, in many instances, there will be a cluster of sites and facilities, some in or near an urban area and others in more distant places. An outdoor-education complex on one piece of land or on several plots in close proximity has many advantages in the areas of administration, leadership, equipment, and transportation. Such a site lends itself to wide community use, with responsibilities for leadership and finances shared by several agencies. Obviously, the size and physical characteristics of an outdoor-education complex will depend on the geographic location and the topography of the land.

Some of the facilities and types of site treatment for a complex that would accommodate a broad program of outdoor education and outdoor recreation, and which would constitute an outdoor laboratory or field campus, are briefly described. It is assumed that there will be many areas and facilities, public and private, that can also be used in a comprehensive program.

Considerations in Selecting and Developing Sites

SIZE

The type of program planned should determine the size of the site. Size alone does not necessarily mean much except that it does affect the numbers of certain species of wildlife that might live in the area. A large area does not necessarily have a diversity of physical features. It may just be level land, harboring only a few species of trees, with no particularly outstanding features. Nevertheless, such an area could be made interesting from an educational point of view, provided good leadership is available.

Many schools, recreation departments, and community agencies already have school sites, parks, and recreational areas that should be developed for outdoor programs. Schools, as well as other agencies, in some sections of the country also have forest lands that could be developed and used in a broad educational and recreational program.

SITE CHARACTERISTICS

The characteristics of the site are also determined by the type of program planned. If plans call for a resident camp, many more requirements must be met than if the site will be used only on a daily basis. If the land and facilities are to contribute to all aspects of the educational curriculum, or if there is to be special emphasis on science, conservation, and outdoor skills, many characteristics will need to be considered, such as the following:

- A location to give some privacy and solitude
- Year-round accessibility by road
- A minimum of natural and man-made hazards
- Interesting geologic features, such as rock outcroppings, open field, flat terrain, and a variety of soil types
- A variety of native vegetation, including woods
- Wildlife that can be maintained with good management
- A pond, stream, seashore, or large body of water
- Demonstration areas for conservation practices
- Woods for practicing outdoor skills and use of native materials
- Sanitary facilities, including good drainage and good drinking water
- Simple shelters in the event of inclement weather
- Proximity to adequate medical and hospital services.

SPECIAL FEATURES

Many kinds of developments are found in various types of outdoor education areas. Some of these are appropriate for camps, some for outdoor laboratories or nature centers, and some for outdoor recreational and sport centers. An outdoor education and outdoor recreation complex would include many site plans and facilities not possible in more limited areas. The adaptability of the area to the proposed program, the cost of construction, maintenance problems, aesthetic considerations, and available leadership are all factors in determining what facilities might be developed in a particular land area or cluster of acreages.

Listed below are some of the special developments that might be included in appropriate sites. Some of the features listed are discussed elsewhere in this chapter and are merely mentioned here. Others, not mentioned in other places, are discussed in more detail.

- Grass, shrubs, and trees. They provide shade, prevent soil erosion, provide food and cover for wildlife, serve as windbreaks, mark the boundary of the property, act as a buffer zone to ensure privacy against an adjacent (presently or potentially) populated area, demonstrate principles of plant growth, serve as a resource for ecological studies, and give practice in forest management. A school forest offers many popular activities.
- A vegetable garden or a bog garden.
- Soil-erosion demonstration areas. Such an area should be rich in vegetation, feature good conservation practices, be situated on inclined terrain, and be located next to a piece of land denuded of its vegetation and also located on an incline. Comparisons can then be made over a period of time to determine what happens to the quantity and quality of soil in both areas.
- Snake pit. A variety of reptiles found in the local area could be kept in a circular pit about 20 feet in diameter and constructed of concrete and stone. Concave walls and a water-filled moat surrounding an island will prevent the snakes from escaping.
- Wildlife sanctuary. Provide mixed plantings and construct birdhouses, feeders, and bird baths to attract a variety of birds.
- Weather station. This is for the study of meteorology and should be located in an area that can be fenced off and locked.
- Council ring. This facility provides a place for campfires, for conducting orientations before field trips, and for other special programs. The council ring should be located in a wooded area to ensure a feeling of isolation. Use logs for seats.
- Nature trails. Develop, if space permits, a variety of trails, each serving a different purpose. One may be a geology trail, winding its way through an area rich in geologic features. Another trail may emphasize the study of erosion, while still another may lead to an historic spot.
- Pioneer living area. Social studies lessons are vividly illustrated in such an area. Dramatize the life of the pioneer, including such activities as making dyes from plants, cooking outdoors, constructing shelters, learning to identify edible plants, and learning other survival practices.
- Observation platform. This platform can be used for observing birds and for studying astronomy. It should be located on the highest point of the property.
- Outdoor zoo. Animals indigenous to the local area are featured. Be certain that arrangements can be made to care properly for the animals caught.
- Miniature gardens. Each garden features a particular grouping of native plants found in the typical setting in which they normally grow.
- Plant grafting. A demonstration area that provides interesting studies in genetics.
- Animal-baiting area. Put a salt lick and some meat in a cleared area. Place loose dirt around the baited spot, spread it, press it down with the feet, and smooth it out. Animals attracted to the area will leave their footprints, which can then be observed and studied.
- Natural preserve. An area could be set aside in which no developments would be made. It would be given complete protection and would provide a spot for the observation of ecological aspects.
- Orienteering courses. The development of several courses for map and compass use would stimulate educational and recreational use of the area.
- Greenhouse. A place for the propagation of plants, some of which may be used for area improvement, is important. A greenhouse would make possible an acquaintance with plants and would be a means of providing projects for study during the off season.
- Winter-sports area. Places for skating, skiing, and coasting would be desirable in those parts of the country that have sufficient snow and cold weather to make these sports feasible.
- Natural play area. An area set aside for children, containing such elements as climbing logs, ropes for swinging across low areas, sandbanks, and hide-and-seek areas, can provide play different from that in the city.
- Turtle pit. An attractive pit with water and plantings would make possible the study and observation of turtles and other amphibians.
- Rifle and skeet ranges. Such an area will provide oppor-

tunities for instruction in gun safety as well as for participation in rifle and skeet shooting.

- Casting and angling area. Developments for casting and angling would serve both instructional and recreational uses.
- Amphitheater. For large-group programs, an amphitheater would be important. It could be used for lectures, drama, music, and a variety of demonstrations.
- Astronomy area. A special area for astronomy may be developed on a large open area, waterfront, dock, or even a roof. Seating facilities are desirable, and sometimes a telescope is permanently mounted to facilitate observations.
- Bird-feeding station.
- Historical markers. Sites of old farms, early settlers' homes, Indian trails and village sites, and pioneer roads are illustrations of the kinds of historical sites that might be used for student projects.
- Shelters. Adirondack or picnic shelters can serve day-camp and day-use groups during inclement weather.
- Tree stump. Locate a fairly well-preserved tree stump, make a sloping cut, smooth the top by sanding, and treat it with a clear waterproofing material, such as fiberglass resin. Much can be learned about tree growth from carefully studying a tree stump.
- Herb garden. This garden features food seasoning and medicinal plants and serves as a useful teaching aid for a home economics class.
- Photographic blind. Construct a blind near a bird-feeding station for taking pictures of wild birds.
- Evergreen-tree nursery. Trees can later be transplanted to desired areas.
- Field archery. Targets are set up in wooded areas or fields, simulating actual hunting conditions.
- Natural areas. Such areas are left relatively undisturbed, and man-made modifications should be avoided as much as possible. These places serve as excellent resources for scientific studies of natural phenomena.
- Picnic site. It is desirable to locate the picnic site on the periphery of the property.
- Seashore areas. Communities adjacent to seashores may have areas set aside for study and observation. Developments might include ramps or walks to facilitate observation. Walkways through tidelands may be developed as nature trails. One of the national parks has an underwater nature trail.

Outdoor Laboratories

The term *outdoor laboratory* is used for a piece of land (including wetlands, lakes, and seashores) set aside by a school for learning experiences directly related to land and its resources. It may be located close to an individual school, or it may serve a group of schools. It may be a part of the school grounds or a section of a park-school development. It may consist of only a few acres nearby or of several hundred acres, nearby or many miles away. It may serve individual elementary schools, high schools, or universities, or all of them jointly. Because outdoor laboratories are extremely varied in their site possibilities and their purposes, no rigid format for their development is possible.

The term *land for learning* has been applied to the school laboratory. It implies the opportunity of school groups to study, explore, and experiment with land and its resources. Outdoor study, field trips, and experiments with water, soil, plants, and animals constitute its major functions.

Developments may range from nothing more than a few trails with the area left natural, to nature trails, class and museum buildings, horticultural plots, developed ponds, forest plantations, gardens, and small-farm operations. The creativity of the teacher or outdoor education specialist, the potential of the available site, and funds available may be the only limiting factors in the development of program facilities.

If a laboratory is heavily used, water and toilet facilities might be essential. A storage building for tools and supplies might also be desirable.

Nature Centers

The term *nature center* is used to designate a particular type of development that will facilitate learning in the outdoors and the growth of recreational interests. The establishment of nature centers is being promoted extensively by the National Audubon Society and the Science for Young Americans Association. Several hundred such centers have been developed in the United States in recent years. Children's museums may be considered a part of this development, although some of these museums lack adjacent lands for outdoor education.

Nature centers have been developed principally by three types of financing and management: schools, private associations, and public park and recreation departments.

THE SITE

Some of the suggestions for the school outdoor-education laboratory are applicable here. Nature trails, ponds, bogs, gardens, forest plantings, and the like may provide the variety essential for a rich outdoor education program.

THE BUILDING

The building should be designed so as to permit expansion as the program grows and as more funds become available. In its initial stage, the building should contain a minimum space of 2,500 square feet, which is large enough to contain one class adequately. The building should be designed according to the needs set by the program. The following general facilities are recommended:

- Office for staff.
- Toilet facilities. Access should be provided to the outside as well as to the interior of the building.
- Large meeting room. The wall space can be utilized for exhibits. Low cabinets along the walls should be provided for storage of educational aids. A long counter providing work and display space should be constructed on top of the cabinets.
- Classrooms. Two classrooms should be provided so that the class may be broken up into smaller groups if necessary.
- Workroom. This room would be used for constructing displays and for arts and crafts.
- Science laboratory. A room should be equipped with microscopes, soil- and mineral-testing equipment, and other materials necessary for scientific studies.
- Library. The large meeting room can contain the library, which would occupy one section of the room. The library should contain reference material, field guides, magazines, and novels concerned with the outdoors.

- Storage room. Adequate space should be provided for storage of the many pieces of instructional and janitorial equipment that will accumulate over the years.

It should be emphasized again that it is not essential for one center to have most of the facilities described here. Dynamic leadership is, to a large degree, more important, and not even the ultimate in good facilities can ever satisfactorily replace the need for effective leadership.

Interpretive Centers

Although the name *interpretive centers* might well be applied to the outdoor laboratories and the nature centers mentioned earlier, it has a specific use in describing certain facilities of public parks offered as a service to the general public and, in some cases, to school groups. The National Park Service has the most extensive development of such centers, although state and metropolitan parks have, in recent years, been expanding the number of their interpretive centers. The U.S. Forest Service is beginning to develop information centers that are essentially interpretive centers.

The primary purpose of interpretive centers is to help visitors understand and appreciate the natural, historical, or archeological features of the areas in which the centers are located. Inasmuch as the problems of interpretation of each area are different, facility developments are likewise varied.

Interpretive centers frequently contain a trailside museum or interpretive-center building. This may vary in size from 10 by 20 feet to a large, multiroomed structure. The size depends on the groups to be accommodated, the interpretive materials available, and the types of programs to be presented. A large building may contain some or all of the following:

- Display rooms with habitat cases and other exhibits
- Office space for staff members
- A laboratory for research and the preparation of display materials
- Meeting rooms for lectures, slides, or movies
- Lavatories and toilets
- A counter for the sale of books and the distribution of pamphlets
- An outdoor amphitheater or campfire area for lectures and movies
- Trails to points of interest (often self-guiding nature trails)
- Parapets or other special observation points, often including mounted telescopes and pointers indicating places of interest
- Interpretive devices at points of interest, including bulletin boards, maps, diagrams, and displays
- Parking areas.

School groups often visit interpretive centers, usually by school bus on a one-day basis. In some cases, picnic areas are provided for such groups. Work space, where children can work on projects at the center, is often a desirable feature.

School and Community Gardens, Farms, and Forests

Gardens, farms, and forests provide direct experiences with growing plants and, in some cases, with domestic animals. Schools, park and recreation agencies, and a few private agencies have been responsible for the development of facilities. Even when facilities are developed and operated by park and recreation departments or private agencies, some direct relationship with schools is often provided through an instructional program in which the school children are enrolled.

DISPLAY GARDENS

Gardens of various kinds should be developed to provide for visual, cultural, and educational equipment.

A formal garden may be composed entirely of one type of plant (such as roses), of various types of assorted plant materials, or of a series of individual gardens comprised of single types of plant units. Features such as a water fountain and statuary can be incorporated into the design.

Informal gardens should have long, sweeping lawn areas to serve as a setting for plants and flower beds. Plants may include large specimen trees, flowering trees, shrubs, and vines. The flower borders can be of varied plants.,

All the plants should be of interest to the average homeowner and should be useful in helping him select plants for his own yard. Attempts should be made to keep abreast of the latest introductions and to display those types of plants that are hardy to the particular region in which the garden is located. This aspect of planting for the homeowner should be stressed in both formal and informal gardens, and demonstrations of plant cultural practices should be provided.

Naturalistic and native, or wildflower, gardens are established in a wilderness location, where the plants native to the region can be assembled in one area so they are easily accessible to the citizens. Developers will probably need an area of varied topography—lowlands, highlands, and prairies—and an area with varied soil conditions—from alkaline to acid—to accommodate the various types of plants.

TRACT GARDENS

In a tract garden, which is the most common type of school or community garden, a piece of property ranging in size from one to ten acres is divided into small tracts for the use of individuals. A typical plot size may be 10 by 20 feet, but adults and families can use larger gardens. A garden program with 25 plots can be set up on one-fourth acre of land, although more space is desirable. Four acres of land can hold 100 gardeners with plots of varied size and community crops. This size allows space for a service building and activity area. It should be on rich, well-drained soil with water available.

Garden programs may involve instruction, environmental projects, field trips, and science activities. Community projects may include novelty crops such as a pumpkin patch, gourds, Indian corn, and a Christmas tree farm. Gardening appeals to all ages and is an excellent program for families.

Some of the necessary or desirable features of the tract garden are the following:

- Garden building—either a small building for the storage of tools and equipment or a building large enough for class meetings and indoor activities during bad weather
- Toilet facilities adequate to care for the maximum number of participants expected on the garden plot at one time
- Greenhouse for plant propagation
- Ready access to water, with spigots and hoses available for limited irrigation
- Fencing for protection of the garden
- Pathways and walkways to provide easy access to all plots
- A demonstration home yard, with grass, flowers, and shrubs
- Good landscaping.

Preferably, the tract garden should be located within walking distance of the homes of the participants.

In many cases, gardens are developed on or adjacent to school grounds.

Tract gardens for adults and families have been established in some communities. They are usually intended for people living in crowded urban centers or apartments who would not otherwise be able to garden.

In some communities, these gardens are located at some distance from homes, and transportation is left up to the individuals concerned.

FARMS

Community or school farms are becoming increasingly important, especially near metropolitan centers, and offer opportunities for a rich and varied program. Farm programs include animal care and training and traditional rural activities such as hay rides, picnics, and nature activities. Model farms are heavily used by families who just want to walk through to see and pet the animals.

Simple barns and pens contain horses, cows, pigs, chickens, sheep, and other domestic animals, which children can help care for and feed. In an urban setting it is essential that the facility be attractive and well-maintained. There must be water, feed storage, and adequate exercise space for the animals. An office, restrooms, drinking fountain, indoor and outdoor activity areas, and storage space are needed for the people.

In addition to the buildings that are generally found on a diversified farm, there are meeting places and exhibits that make it possible to carry on indoor instruction. Picnic areas, farm ponds, day-camp facilities, campfire circles, and hiking trails are often developed also.

Working farms are sometimes adapted for recreational purposes. This type of facility actually produces while city residents visit to learn, observe, take part in, and enjoy farming activities. Groups may use the farm on a day basis, and overnight accommodations can be provided. In either case, a large room and open outdoor space are needed for activity and instruction.

Farm camps offer opportunities for a farm-oriented camping experience. The farm camp is a farm not worked for production but set up for resident programs in environmental education, farm activities, natural history, science, and other outdoor recreation. There may be a large farmhouse converted to a program building and farm buildings converted to cabins. Facilities needed are a kitchen, dining area, sleeping quarters, restrooms, large activity room, and ample storage space. In addition barns, animals, farm equipment to maintain the area, and other facilities will be needed depending on the program direction.

FORESTS

Over 1,200 school and community forests are to be found in the United States. Many of these were acquired from tax-delinquent land, through gifts, or through protection programs for community watersheds. Their use has followed diverse patterns. Some schools have carried on field trips, forest improvement projects, and other outdoor education activities. In general, however, schools have not made the maximum use of such areas.

Many of these forests could be developed as outdoor education laboratories. Some might be suitable sites for nature centers, day camps, or even resident camps.

School and community forests may serve valuable purposes even without extensive development. Water, trails, and toilets may be all the developments needed to provide useful educational facilities. Such areas may serve their best functions as places in which to study the ecological changes taking place over a period of years.

Outdoor Skills and Sports Area

Outdoor skills or sports areas should be included in the outdoor education-recreation complex, but it may be necessary to acquire special sites, depending on the topography of the land. These areas should provide opportunities to learn and to practice skills, but they may also be used as outdoor laboratories.

The following are some of the specialized program facilities that might be included in the outdoor skills and sports area:

- Casting and angling—platforms and open, level spaces
- Outdoor shooting range
- Archery range—target field course, archery golf, and other games
- Campcraft skills area
- Overnight camping area
- Outpost camping—Adirondack shelters
- Facilities for water sports, including swimming, canoeing, boating, sailing, skin diving, and water skiing
- Area for crafts with native materials—carving, lapidary, weaving, and ceramics—with a simple structure for inclement weather and to house equipment
- Winter sports—ski slopes and tow, ski shelter, tobogganing, and ice-skating rinks.

Natural Areas

Natural areas are generally thought of as representative of the original, undisturbed plants and animals of a locale. They may encompass a variety of habitats, such as woodlands, deserts, swamps, bogs, shorelines, or sand dunes.

It is almost impossible today, even in the wilderness, to find undisturbed areas. Most places categorized as natural areas are protected lands that indicate the least disturbance and that, through protection, planting, and development, approximate the original characteristics

It is characteristic of natural areas that they are protected from nonharmonious developments and activities. Simple access trails, protective fencing, and simple interpretive developments such as entrance bulletin boards are usually acceptable. In designated natural areas, the enjoyment and study of the natural features are encouraged, and uses that detract from the natural features are discouraged.

Schools, parks, and camps are often the agencies that develop, maintain, and protect natural areas. Such areas are valuable assets in environmental education.

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Chapter 4

CAMPS and CAMPING

Historically, the word *camping* signified simple living outdoors and engaging in activities related primarily to the outdoors. Today the term has broadened tremendously and encompasses a wide spectrum of developments for families and children. *Resident centers, day camps, group camps, family camps,* and *wilderness camps* are the common designations used for the various types of camps.

Camps have been developed by public agencies at all levels of government and by many voluntary youth-serving organizations. The rapidly increasing participation of children and adults in camping necessitates careful consideration of desirable areas and facilities.

Although most organized camping takes place on agency-owned or private property, public land is becoming increasingly involved. Public land is one of the major resources for school outdoor education programs, and many resident centers have been constructed on public property or by public funds. Schools use the facilities during the school year, and park and recreation agencies use them during the summer. The purposes of outdoor education, whether sponsored by park and recreation departments or by schools, are similar in many respects, and cooperative planning is not only necessary in order to get the most from the community dollar but imperative if suitable lands and sites are to be obtained. If adequate facilities are to be provided to meet the needs of both organized camping groups and schools, the facilities must be designed for year-round use.

RESIDENT CAMPS

The term resident camp is used to designate an area that provides for 50 to 150 people, with facilities for cooking, sleeping, and program development. There are three major considerations in the development of resident camps: (a) selecting the campsite, (b) planning the layout and development, and (c) constructing the buildings and facilities.

Selecting The Campsite

The selection of a site for a camp in which children and adults can live and learn is no small task. Both vision and technical knowledge are required. There is no such thing as a perfect campsite, and the plans will need to be adapted to the site available.

Camps should not be so close to campers' homes that parents can drop in at odd times. Campers feel more of a sense of adventure when camp is somewhat distant from home. About 40 or 50 miles is a desirable minimum distance. If distances are too great, however, travel costs become prohibitive. A site should offer both a sense of seclusion and reasonable accessibility.

It is advisable to secure a tract large enough to provide for future growth. At least an acre per camper, in terms of predicted future use, is a minimum. If the land is especially "tender" and intensive use is planned, an even larger minimum should be considered.

Land with a varied topography and possibilities for many types of outdoor programs is highly desirable. Generally the more natural the area the better, though serious natural hazards should be avoided. Level land for buildings and certain programs is important. Drainage and factors related to use during different seasons should be borne in mind.

Water for both program and domestic purposes is essential. Water activities are important in most camps and, if not naturally available, will need to be provided artificially.

Planning the Layout and Development

Money will be saved and mistakes reduced if a camp planner, architects, and engineers are engaged to develop a master plan. Problems are considerably different from those in other types of developments, and there is no substitute for specialized technical help. All groups who will use the camp should be considered in the plan. Planning should include consideration of the following:

- Present needs and possible future demands
- Purposes and objectives of the camp
- Possible year-round use
- Groups that will use the camp—age, sex, and socio-economic background
- Program of the camp
- Leadership
- Transportation available
- Financing of construction, maintenance, and operation
- Protection—fire, police, and off-season
- Accessibility and seclusion
- Aesthetic values.

Because a large part of the program in most camps is related to the environment, camping should take place in a natural and protected area. However, whenever large numbers of people use an area they disturb the natural resources. Camp plans should be concerned with minimizing the damage to resources through protection; careful location of buildings, roads, trails, and utilities; and planting, drainage management, and surfacing where needed.

The U.S. Soil Conservation Service will assist camps in developing land capability maps that indicate how certain land may best be used. The Service often has aerial photographs that can help in planning. Topographical maps can be obtained from the U.S. Geological Survey. Additional surveys may be required to give greater detail. Five-foot interval maps are usually required for construction purposes. To protect camp resources, the help of capable persons in surveying the plants, wildlife, and waters of the site should be secured.

A general layout should be planned, indicating the location of roads, utilities, buildings, and program facilities. Even though all of the plans cannot be realized immediately, they should be included.

Most resident camps today are decentralized, with either units for 18 to 30 campers or small camps for 10 to 12. If there is winter and school use, more centralized facilities for larger groups may be advisable.

The lay of the land with its natural divisions will often determine construction sites, and plans should be flexible to take advantage of the land. The following, however, are considered desirable distances between structures:

- Cabins—at least 100 feet apart
- Units or small camps—500 feet apart, or so located that there is little interference from one another
- Health center—at least 200 feet from other facilities
- Wash houses or toilets—within 150 feet of living facilities.

The main access road should be 18 to 24 feet wide and should enter the camp as far as the parking lot. The camp should have a parking lot sufficient for the number of vehicles that would normally be accommodated, taking into account that at times there may be need to park several school buses. A relatively flat, open, and well-drained area nearby can serve as an overflow parking area.

Normally, it will be expected that passenger cars will not penetrate the campsite proper. A spur drive from the main entrance road should be constructed to the kitchen and other basic facilities.

A trail system should follow natural travel routes to camp facilities. Well-planned and developed trails will protect the natural environment.

The first building approached when one enters camp should be the administration building, and the next should be the dining hall. These buildings are main points of interest, for it is around and in these facilities that many camp activities will be centered. The buildings should be placed within easy access to both the parking area and the living units.

Constructing the Buildings and Facilities

Since camp structures represent a large investment, they require the best of planning energies and abilities. Not only do these structures provide for the basic need of shelter, but they also create an atmosphere about the camp that can be a definite aid to the camp program.

The designer's objective should be to develop an exterior appearance that is suited to the region, the site, and the camp program. Contrary to popular belief, nearly all of the standard building materials can be used to produce an attractive building. The problem of annual maintenance, as well as appearance, must be considered. Native materials should be used wherever feasible and practical. In every way, the architectural treatment of the exterior and interior of buildings and other structures should be in harmony with the motif of real camping and with the natural environment.

The structures should be planned to meet all presently known and anticipated needs. It is helpful to study plans of existing facilities and to interview present camp directors. Visits to facilities that have been in use a number of years are most beneficial. However, one should never assume that a camp plan applicable to one site should be duplicated exactly on a different site or for a different camping use. Each camp designer will have to adapt such plans to the needs of the local program.

ADMINISTRATION BUILDING

The administration building will house all the administrative functions of the camp. There should be office space for the camp director and assistants, a conference room, a secretarial room, a workroom for mimeographing and mailing, and toilet facilities for men and for women. Provision should be made for processing the entering and departing campers.

Telephones should be located in both the office and the health center. A public telephone is not usually recommended, and calls by children should be made under staff supervision.

DINING HALL, KITCHEN, AND STORE

A central dining room should contain at least 12 to 15 square feet of dining space per person. It should be attractive, comfortable, and heated if used in cold weather. It should be located within five minutes' walk of camp living quarters.

The dining room should be designed so that the campers may be served at their respective tables. The lighting should be adequate, well-distributed, and without glare. Ease in cleaning is also essential. Light-colored asphalt, rubber, vinyl asbestos, or terrazzo tile make an acceptable floor covering.

Coat racks, toilets, and a fireplace may be included in the plans. Easy access from the dining room to the kitchen food-service counter is important.

A person experienced in kitchen arrangement and equipment should be consulted in planning the kitchen. It should be at least one-third the size of the dining hall and should have facilities for food preparation, cooking, refrigeration, dish-washing, and storage. Greaseproof asphalt tile is a suitable floor covering.

Adjacent facilities should include a loading platform, a garbage crib, the dietitian's or head cook's office or desk space, a camp store for supplying food to cookout groups, the camp post office, and the bank. Toilet and lavatory facilities should be provided for the kitchen staff.

HOUSING UNITS

There are several approaches to the design of housing units, depending upon the needs of the group and the program. Some camp administrators prefer to house an activity group together in one large unit, while others prefer smaller, decentralized units.

Most new camps have decentralized layouts. Camps for handicapped people and camps used the year around have special requirements related to size and winterization of living facilities.

In the large housing-unit arrangement, both boys and girls or men and women may be housed in the same building, with sleeping rooms separated by a common living room (see Figure 1). It is desirable to locate each staff room adjacent to the lounge and sleeping room so that adequate supervision can be maintained. In a school camp, this arrangement makes possible a good teacher-camper or

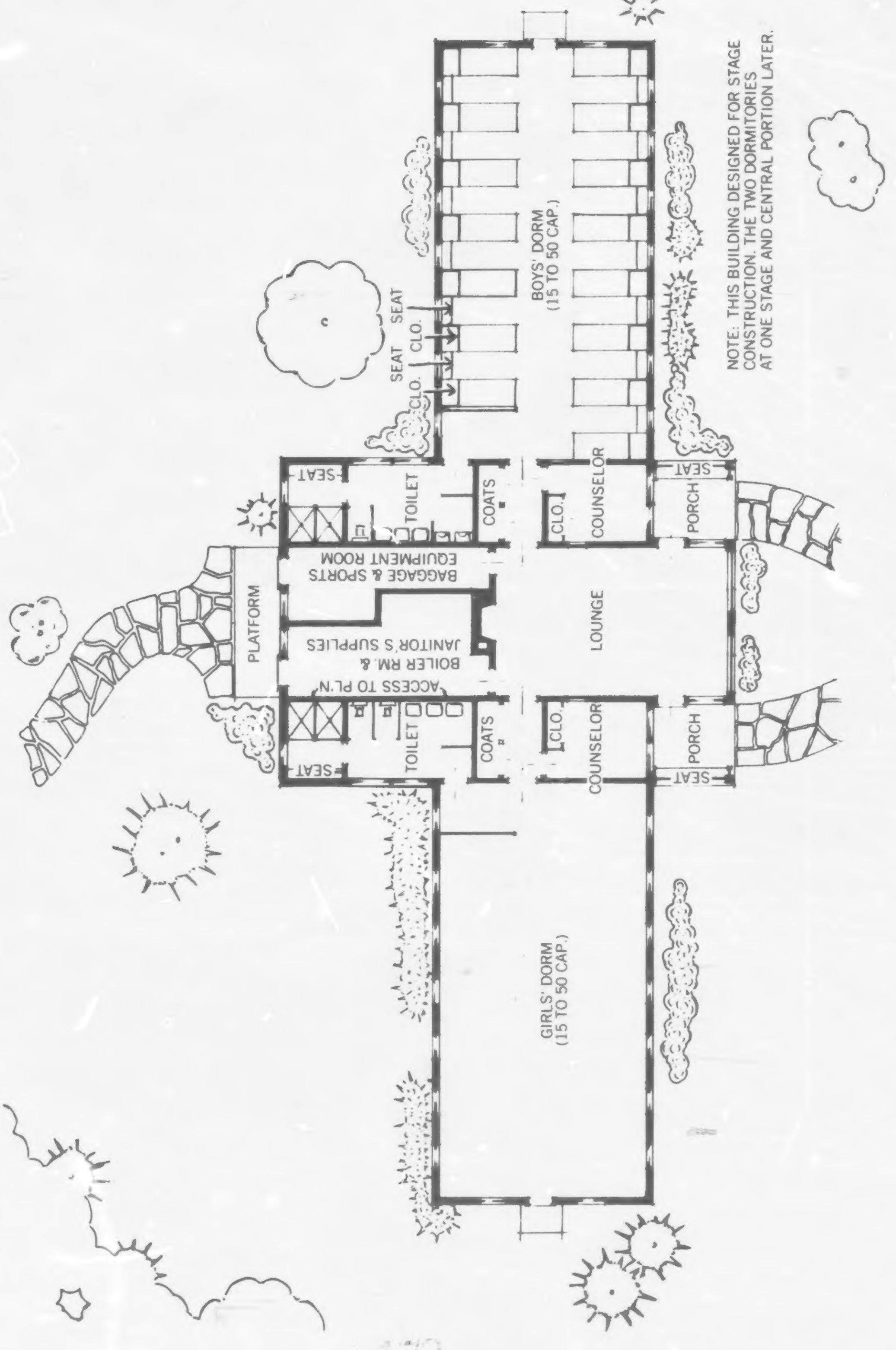
BOYS' DORM
(15 TO 50 CAP.)
SEAT
CLO.
SEAT
CLO.
NOTE: THIS BUILDING DESIGNED FOR STAGE
CONSTRUCTION. THE TWO DORMITORIES
AT ONE STAGE AND CENTRAL PORTION LATER.
SEAT
TOILET
COATS
CLO.
COUNSELOR
PORCH
SEAT
BAGGAGE & SPORTS
EQUIPMENT ROOM
PLATFORM
BOILER RM. &
JANITOR'S SUPPLIES
ACCESS TO PL'N
LOUNGE
SEAT
TOILET
COATS
CLO.
COUNSELOR
PORCH
SEAT
GIRLS' DORM
(15 TO 50 CAP.)

Figure 1. Floor Plan of Large Housing Unit.

counselor-camper living relationship.

In a resident camp designed for the use of schools, each housing unit should accommodate 25 to 30 campers. Single beds are recommended. It is also desirable to have kitchenettes in case the central dining hall is not used. Kitchenettes are especially convenient if the camp is to be used for small adult-education groups, conferences, or workshops. Flush toilets and showers should be adjacent to the sleeping rooms. Not only is this style of building suitable for adult groups, but it is highly recommended for winter camping for young children.

At least 40 square feet of room per camper should be provided in sleeping quarters, and cots should be placed at least three feet apart and so arranged that campers' heads are at least six feet apart.

Architectural design, insulation, and the heating plant will vary with the climatic conditions of the area. Comfortable beds, springs, and mattresses with water-repellent mattress covers should be provided. There should also be storage cabinets for clothes, suitcases, and personal items. Mirrors should be provided in the sleeping room and washrooms. Each sleeping room should have one writing table and chair per eight children, if these are not provided in the living room or lounge. The general lighting should be subdued, but there might be student lamps for the writing tables.

Some groups prefer to have smaller housing units more widely dispersed. This plan lends itself better to unit construction, which makes it possible to build some camp facilities immediately and add more units from year to year. It does, however, require more night-time staff. In addition to the well-placed and well-spaced housing units, there should be a central main building containing the food-preparation and dining facilities.

Small housing units (see Figure 2) should be equipped with the minimum utilities. Each housing unit or cabin will accommodate approximately eight to ten campers and staff. In certain sections of the country, it is desirable to provide toilet and shower facilities in each housing unit, especially in a year-round school camp in a cold climate. In other parts of the country, unit-type toilet and shower buildings could be provided to serve more than one housing unit. The number to be served would depend upon the unit site and location.

Buildings or canvas shelters should be designed so as to seem to belong in the camp environment. Tents, tepees, covered wagons, and other movable living quarters are common in decentralized camps, but cabins are needed in severe climates.

There are two schools of thought on counselor-camper living. One maintains that counselors should live adjacent to but not in the same room with campers, whereas the other prefers that counselors live with campers. If counselors live with campers, some type of partitioning is advisable. In large winterized quarters, separate rooms for counselors may be provided next to campers' sleeping rooms.

Additional housing is usually needed for program specialists who are not charged with the daily supervision of camper groups. A staff house with sleeping rooms and a lounge for the use of counselors when off duty is often provided.

The director, program staff, and caretaker, if living at

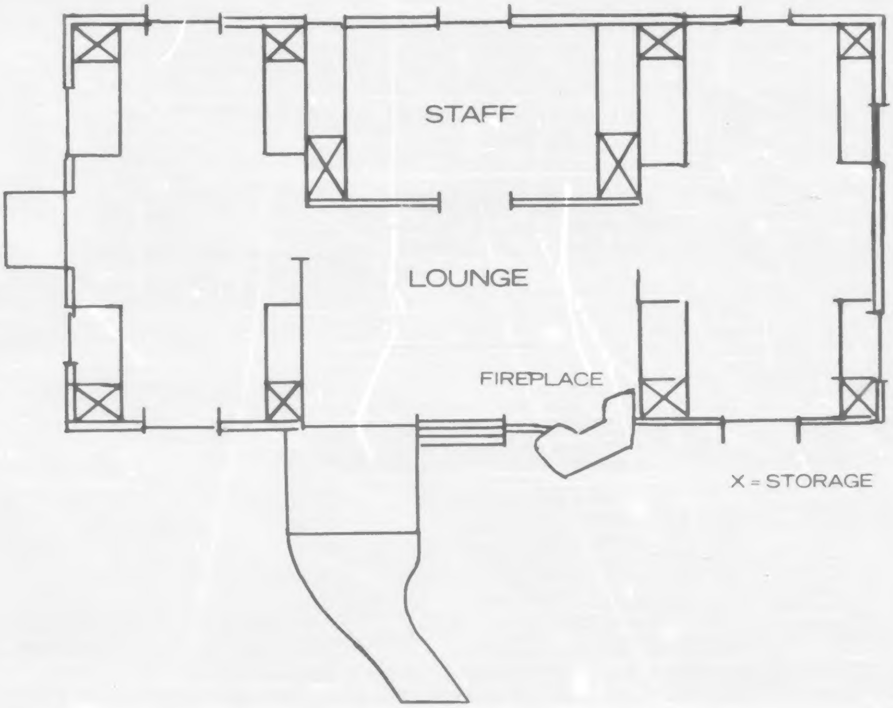

Figure 2. Small Housing Unit.

camp the year round, require homes with reasonable comfort. Family homes should be located near the property entrance to assure supervision.

HEALTH CENTER

The resident camp needs a center to provide health care and to house the camp nurse. Desirable features include the following:

- Space for ill campers—one bed for 20 campers, with separate rooms for male and female patients
- Isolation room for observation and temporary care of campers with suspected communicable diseases
- Treatment room
- Office space for records and nurse's work
- Housing for camp nurse
- Bath and toilet facilities
- Water heater
- Hot plate for simple food preparation.

SHOWER HOUSES

A camp without showers in the living quarters may have a central shower house or several shower houses. These should provide lavatories and flush toilets as well, and laundry facilities are desirable. The following are minimum needs:

- One shower head for 10 to 15 persons
- One toilet seat for 8 to 10 girls
- One toilet seat for 12 to 15 boys
- One urinal for 30 boys
- One lavatory for 10 persons
- Heated water for showers.

GENERAL MAINTENANCE BUILDING

A building of sufficient size to store the necessary equipment for maintaining the camp is desirable. It should include space for trucks, a tractor, ground maintenance machinery and tools, repair materials, and a room for miscellaneous repair work. The design of the building will depend upon the type of equipment to be stored and the nature of maintenance work to be performed by the resident maintenance staff.

Fire-fighting equipment should be kept readily available. Some campsites need fire-control systems with hydrants and hoses.

Tools, power equipment, gasoline and other flammable material should be kept under lock and key and used only by authorized personnel.

SEWER, WATER, AND UTILITIES

Resident camps need to develop their sewage systems carefully. The state board of health should be consulted during the planning so that state health requirements and antipollution regulations are met. Several systems may be acceptable, such as absorption fields, aeration systems with lagoons, or dry wells. State health boards generally prefer flush toilets to pit latrines, although the latter, if properly constructed, may be acceptable in decentralized living quarters.

Provision must be made for disposing of solid wastes. Community waste disposal areas, if available, are preferred. Sanitary landfills are generally considered desirable.

Adequacy and purity are the chief features to be sought in the domestic water supply. The help of the state board of health should be enlisted to assure development of an approved system. The amount needed depends on the type of camp, but a minimum of 100 gallons per person-day is usually suggested in these days of increased water usage. An adequate reserve supply should be maintained for fire and other emergency use.

The possibility of securing water from community sources should be explored. Drilled wells are generally preferred to dug wells or springs. Surface water needs to be filtered and chlorinated. Data on available water supplies may be secured from state hydrogeologists, local well-drillers, or nearby residents. Adequate and approved drinking fountains should be installed at strategic places of need.

If camps are used only seasonally, provision must be made for winter protection or drainage of water.

Electricity is usually needed in the kitchen, dining hall, office, and health center. Opinions differ on the desirability of electricity in living quarters; but if camps have winter use, electricity is generally included in living quarters.

Natural gas is usually preferred for kitchen cooking and heating.

PROGRAM FACILITIES

Following are some of the facilities used for various camp programs. Specifications and construction details for most are found elsewhere in this book (see Index).

Water developments. Water-related activities are among the most popular in summer camps. During the fall and spring, school groups and other groups may use developments for fishing, canoeing, and boating.

Lakes, ponds, streams, bays, and inlets offer many recreational opportunities. All should be studied in detail with regard to currents, eddies, depth, slope, shoreline, debris, and other factors.

Canoeing, boating, and sailing are activities that may be conducted on a lake, pond, river, reservoir, bay, or other body of water. The water area should have accessory facilities such as floats, docks, markers, or buoys. Various sizes of water bodies are required for different activities and events. For instance, canoe-racing courses are 100, 200, 440, and 880 yards as well as one mile. Sailing requires a wider body of water because the boats usually finish to windward. The different classes of sailboats, such as sunfish and sailfish, require different courses.

Casting is simulated rod-and-reel fishing. Practice casting on a playing field or in a gymnasium is possible the year round. If a pond or lake is nearby, a beach or dock affords an excellent facility for the casting program.

In order to teach all phases of the activity, an area 300 by 100 feet is desirable. A football, soccer, hockey, or lacrosse field is ideal for class instruction.

Casting targets, which are 30 inches in diameter, are easily constructed and can be an excellent project for any woodshop program. It is recommended that at least 10 targets be made. Others can be added as the program expands. Targets for use on the water are also 30 inches in diameter and are made of hollow metal tubing. They float and can be easily anchored.

Campfire circles and council rings. Most camps develop centers for meetings and evening programs.

Craft centers. These may range from canvas-covered areas with provisions for storing tools to extensive and well-equipped craft shops.

Recreational buildings. Space for indoor activities, especially during bad weather, is sometimes provided by an additional story on the dining hall. Separate recreational buildings may be constructed.

Shelter houses. Wooden or canvas shelters for program purposes may be located in individual units.

Shooting ranges. Archery and target ranges are found in many camps.

Open sports areas. These range from open grassy areas for informal play to well-equipped sports fields.

Horseback riding stables. Horseback riding is an expensive but very attractive addition to camp programs.

Environmental education centers. Varied facilities ranging from open meeting centers to completely equipped indoor laboratories serve as work centers in natural science.

DAY CAMPS

A day camp is an area and facility intended to provide a program similar to that of the resident camp except that campers sleep at home.

Planning Considerations

Many of the considerations of planning mentioned in the section on resident camps apply to day camps. However, facility problems are simpler because day campers sleep at home and usually eat two of the day's meals at home. Provisions, however simple, must nonetheless be made for water, toilets, rainy-day shelters, eating and cooking, refrigeration, first-aid and health, and program.

Abundant land for programs is extremely desirable, particularlywhen the emphasis is on outdoor-related activities. Reasonable isolation and a varied topography with outdoor program possibilities are essential. Natural parks, park-school areas, and community forests often lend themselves to use as day-camp sites. Some communities have developed special day-camp areas; others make appropriate picnic areas available for this special use.

Buses are often used to transport campers to the day camp. If more than half an hour is consumed in daily travel each way, the effectiveness of the program is reduced.

Units and Facilities

Day-camp groups are divided into units or counselor groups ranging from 8 to 20 campers. Most day camps provide simple facilities for each unit, including a fireplace for cooking, storage cabinets, and tables. Some day camps serve a daily meal in a central dining hall, reducing or eliminating the need for unit cooking facilities.

Storage is needed for equipment, food, and program supplies. Some day camps use trailers or trucks for storage, hauling them back and forth each day.

A well-equipped first-aid station and a rest-area facility are necessary.

GROUP CAMPS

Many public agencies today provide special campsites for small groups, such as scouts, church groups, and school classes. These sites generally accommodate from 10 to 40 persons. In most cases, the groups stay from one to five days. Small units in decentralized resident camps sometimes have facilities that can be used for group camping.

Simple fireplaces for cooking, picnic shelters for use in bad weather, toilets, and safe drinking water are necessities.

The great increase in winter camping by small groups often necessitates special developments. Some winter campers live completely outdoors in the cold, even in snow. Usually, however, winterized buildings are used for cooking, sleeping, and evening activities.

FAMILY CAMPS

At one time "family camping" meant the activity of families pitching tents in natural areas, living and cooking simply, and finding their own interests outdoors. Today the term may include sleeping in tents or living in expensive motor homes, stopping overnight or vacationing in completely equipped resorts with varieties of entertainment.

Overnight or transient camps are usually strategically located for travelers passing by or for those wishing to visit nearby points of interest. These camps need to offer very little, chiefly cleanliness and comfort for short stays. They generally do not provide natural areas and recreational facilities.

Family resident camps offer complete meal and living accommodations for families or adults. The facilities may be similar to those of resident camps except that some of the sleeping quarters may be adapted to families.

Most of the campgrounds in state or federal areas are destination camps. Campers generally stay more than one night and often for several weeks.

In recent years a great many resort camps have sprung up. These resorts, generally privately developed, are more or less complete vacationlands in themselves, offering, frequently under leadership, a recreational program and facilities including swimming pools, recreational buildings, children's playgrounds, special game courts, marinas, horseback riding trails, and the like.

Planning Considerations

Development plans will depend on whether the campgrounds are intended to offer natural outdoor living experiences or just living space for overnighters or those who will spend their daylight hours visiting surrounding areas. The demand or market should be studied before plans are drawn.

Location is an extremely important factor in success. One-nighters do not wish to detour far from their main line of travel. Destination campgrounds should be near interesting areas or themselves offer attractions so that campers will stay.

The reasons for camping are extremely varied and sometimes appear contradictory. Studies indicate, however, that campers in destination campgrounds rate water activities, such as swimming, boating, and fishing, high on their lists. Socializing is important for some campers. Campfire programs and social activities attract many, but others seek solitude and outdoor experiences. Children's playgrounds or play space are important to many families.

Features and Facilities

WATER SUPPLY

An ample and safe water supply is essential. Water systems must meet state health requirements and be adequate for users.

Unless water is supplied to each individual site, a water pump or faucet should be available in a central location for each 10 to 15 sites. If camps are operated in cold weather, these should be resistant to freezing.

Many camps have some complete hookups and some partial hookups. A water hookup to a recreational vehicle necessitates a sewage hookup as well. Fill and waste valves are generally prohibited. With hookups, standard hose connections for sewer pipes are provided for connection to the left side of each recreational vehicle.

With increased demand for clean toilet facilities, wash houses have come to be considered necessary. They should be located within 300 to 500 feet of camp sites. Facilities should be provided as follows:

	Men	**Women**
Flush toilets	1 for 30 sites	1 for 15 sites
Urinals	1 for 30 sites	
Lavatories	1 for 15 sites	1 for 15 sites
Showers	1 for 30 sites	1 for 30 sites

Dumping stations are desirable where recreation vehicles are accommodated without complete hookups. Sink water and dishwater disposal can be problems, and drain pits should be provided. Camps anticipating lengthy stays should provide laundries, either in wash houses or separate buildings.

GARBAGE AND REFUSE DISPOSAL

Provision for refuse disposal is an important aspect of campground development. Insect problems, odors, smoke, unsightliness, and the public health are at stake.

Refuse should be placed in durable, water-tight, nonabsorbent, and easily cleaned containers. Heavy-duty galvanized 20- or 30-gallon containers with plastic lining bags are widely used. Garbage from individual campsites should be wrapped in newspaper before being placed in containers. The containers should be placed no farther than 100 feet from camp sites. There should be a container for each two to four campsites. The containers should be placed on bases or hung from brackets above ground level.

ADMINISTRATIVE FACILITIES

The office should contain general office space, first-aid equipment, telephone (preferably a pay phone for campers), and information center. Sometimes the office may be part of the operator's home. The operator must maintain a register of campground occupants and include information required by state agencies.

Centrally located bulletin boards should give information regarding campground rules, how to report a fire or reach police and doctors, church services, parks, golf courses, laundries, auto repair shops, shopping areas, special events, and other items of interest in the locale. Maps of the campground and surrounding area are desirable.

Many camps operate small stores with limited supplies of groceries and equipment. A store is feasible only if there is a fairly large camp population.

INDIVIDUAL CAMPSITES

Six to eight sites per acre are common in natural areas, with 50 to 75 feet between tent or vehicle locations. Minimum size for a site is about 2,500 square feet. In transient or even resort camps, recreational vehicles may be allotted as little as 30 by 40 feet each.

Tent campers require space for tents, outdoor cooking, and camp living. Grills or combinations of grills and fire circles for evening campfires might be provided.

There is a tendency to provide electricity even if no other hookups are provided in sites in natural areas. In transient camps and often in resort camps, complete hookups with sewer connections, water, and electricity are usually available.

Outdoor tables with benches are needed by tent campers but not as much by users of recreational vehicles.

Access for recreational vehicles to individual sites requires careful planning. Most campgrounds provide back-in spaces, which make it possible for four vehicles to obtain water and electrical connections from one post, thereby reducing utility costs. A rather wide road is needed when back-up spaces are provided, so that large trailers may be maneuvered into place. Some campgrounds provide convenient drive-through sites.

SURFACING

Natural woodland surfaces and grass are desirable in natural areas. Since these surfaces are subject to erosion with overuse, areas should be rested from time to time if adequate space is available. Grass is the surface preferred by most campers but is often difficult to establish and maintain.

Gravel or hard surfacing is generally essential for drive-ins and back-ins. Gravel is also provided in areas adjacent to recreational vehicles. Cement pads may serve as walks and patios for individual sites.

PROGRAM FACILITIES

Because campgrounds differ so markedly, program possibilities also differ. Overnight campgrounds may find a lounge, a children's playground, and a small pool more than adequate. In many natural areas, the surroundings themselves may be the greatest attraction, and few developments may be needed. A few of the many possibilities for program developments are suggested here.

Water Activities

Water is one of the most important recreational attractions, particularly for destination campgrounds, as it provides for swimming, boating, fishing, and scenic beauty.

Swimming and boating facilities are discussed elsewhere in this publication. Marinas may range from simple boat docks or beaches to full-fledged marinas for large boats. Specifications for marinas are discussed in Part Four, Chapter 3.

A fish-cleaning center is needed if fishing is an important sport. A cleaning table with running water and a drain into sewage facilities should be available, either open or enclosed in a fly-tight building. Containers for discarded parts are essential. The areas must be kept clean or they become aesthetically and hygienically offensive.

Boat rentals, motor repair, and sales of bait, motor fuel, and fishing equipment are important sources of revenue in many camps. These features require suitable buildings, equipment, and personnel.

Picnic Grounds

Picnicking use varies from a single-family picnic to a large-group picnic involving several thousand people. Accommodations range within these two extremes and require careful planning to ensure proper control and maintenance.

In large parks providing picnic groves and fireplaces accommodating an appreciable number of people, a large open shelter with a fireplace in one end is highly desirable to give protection from sudden rainstorms. Shelters are built in varying sizes from 20 by 30 feet, accommodating approximately 60 persons seated at picnic tables, to 30 by 50 feet, which will accommodate about 150 people. It has also been found desirable in some areas to provide electrical service for night-picnic use.

The areas of heavy use, such as near the picnic shelter, toilets, and drinking fountains, should be hard-surfaced. These sections, then, should have tables for large groups and be located near the parking area. The area for smaller gatherings and play equipment should be located beyond the facilities for large picnic groups. The groupings of picnic facilities, such as tables, easily accessible trash receptacles, and fire grates, should be designed to take advantage of the topographical features, trees, fine views, and other similar factors that make an outing a pleasurable experience.

Tables of various kinds of material are available. In congested or metropolitan areas where picnic grounds are subject to continuous vandalism and destruction, and where there is not much supervision, picnic tables that will withstand abuses from the general public should be provided. Normally, this will require a table in a fixed location and with a hard-surface area under it.

In the more native or natural areas away from heavy populations, such as county or state parks, heavy rustic types of wooden picnic tables and facilities may be more desirable because of their appearance and the fact that they blend with the natural surroundings. Usually, these types of areas are not as heavily used, are not so susceptible to vandalism, and have more space available for the distribution of picnic uses so that the surfaces of these areas do not become worn out, as is frequently true of city parks.

Other features that may be incorporated in picnic areas are a council ring, barbecue pit, and picnic shelter. There seems to be a general trend toward people bringing their own cooking utensils, and it has also been the experience over past years that a small picnic grate for charcoal use is highly satisfactory and more economical to construct. A large fireplace made of stone or other similar material is subject to vandalism and deterioration.

Other Facilities

Recreational buildings may be simple, open-sided shelters or fully developed buildings containing many of the features of community buildings described in Part Four, Chapter 2. In overnight camps the buildings may provide shelter for eating and bad-weather activities. In resort camps they may house full programs including square dancing, bingo, cards, slide shows, lectures, group singing, and so on. An indoor lounge for informal get-togethers, reading, and watching television is often provided.

Large grassy open spaces offer opportunities for informal play. Campgrounds of all types frequently contain equipped playgrounds for children.

Hiking trails, horseback trails, and self-guiding nature trails are popular facilities. Commercial campgrounds sometimes provide facilities for miniature golf, volleyball, badminton, shuffleboard, horseshoes, ping pong, and other sports.

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Part Five–Indoor and Outdoor Swimming Pools

The vast expansion in aquatics in the United States during the past two decades places new demands upon planners of facilities for athletics, physical education, and recreation. General considerations in pool planning and construction are normally the same for aquatic facilities in schools and in communities. This chapter has been developed to aid pool planners in designing facilities that will be adequate to meet the present and future aquatic needs of a particular institution.

DESIGN AND PURPOSES

The swimming pool or natatorium should be designed to serve the present and projected needs of the specific community. It should help to meet the basic objective of the institution's program in athletics, physical education, and recreation. In brief, this objective is to promote the total development of individual members of the community physically, mentally, spiritually, and socially.

Aquatic facilities should be planned in the light of the aquatic program to be offered. In order of priority, it is important to program for swimming instruction, lifesaving and water safety, competitive swimming, the adapted aquatic program, research in aquatics, and recreational aquatics for the community.

PLANNING CONSIDERATIONS

Reference materials should be consulted for up-to-date information on pool planning and construction [see references at the end of this chapter].

Design

If the aquatic program is to include competitive swimming, the pool should be designed according to the following specifications of the National Collegiate Athletic Association and the Amateur Athletic Union: rectangular, minimum dimensions of 75 by 45 feet, containing six 7-foot lanes. For markings, refer to current rule books.

The design program, when completed, should represent a careful balance of such factors as pool size, competitive requirements, recreational activities, diving interest, planned water activities, subsoil conditions, filtration-plant economics, advantageous shell construction, imposed budgetary restrictions, future expansion possibilities, code regulations, possible operational program changes, and imposed site or technical limitations that will affect the final pool design. The pool professional—engineer or architect—is charged with preparing plans and obtaining bids for a project after the design program is formulated.

Table 1. MINIMUM RECOMMENDED OCCUPANCY DESIGN FACTORS

Activity	Indoor Pools	Outdoor Pools
Shallow-Water Area (Under 5′-0″)		
Recreational Swimming	14 sq. ft./capita	15 sq. ft./capita
Advanced Swimming Instruction	20 sq. ft./capita	15 sq. ft./capita
Beginning Swimming Instruction	40 sq. ft./capita	15 sq. ft./capita
Deep-Water Area (over 5′-0″)		
Recreational Swimming	20 sq. ft./capita	25 sq. ft./capita
Advanced Swimming	25 sq. ft./capita	30 sq. ft./capita
Diving (based on area within 20 ft. of deep-end diving wall)	175 sq. ft./capita	200 sq. ft./capita
Minimum Walk Width*	6 ft.	12 ft.
Sum of walk dimensions*, on either side of the pool length or width, shall not be less than	18 ft.	30 ft.

*Walk dimensions shall be horizontal clear deck width, not including any portion of the coping or interior gutter sections.

Final determination of the safe bathing load, using the recommendations in Table 1, can be established by considering the supervision available, the method of instruction, and the nature of the activity being conducted. For example, one instructor with no assistance should supervise only 20 to 25 nonswimmers in a class.

While the size and occupancy factors indicated in Table 1 will facilitate optimum pool design, other considerations are important. There is a correlation between pool capacity and repeated, or shock, loading. A filter plant well-designed for one or two peak loads per day will be unsuited for a new (peak) load of swimmers every half hour. Either the peak load (occupancy factor) or the design basis of the filtration plant has to be changed to ensure the purity of the pool water. Experienced judgment should be carefully exercised in determining capacity and related design where heavy loadings or unusual factors are operative. In the case of pools that will experience heavy loadings, filtration plants with larger capacities are essential.

The pool depth should range from 3.5 or 4 feet to 9 or 12 feet, according to the type of diving-board installation. This size pool should have not more than two 1-meter boards, or one 1-meter and one 3-meter board. If there are diving boards of different heights, they should be placed so there is a lateral distance between them of at least 10 feet, measured from the midpoints of the boards. Boards should also be placed 10 feet in from the sides of the pool.

There is a growing trend toward building the Olympic-size pool—50 meters by 75 feet, one inch—with eight lanes (see Figure 14). Consideration should also be given to a pool with an overall depth of five feet. This type of construction does not permit the use of diving boards and is not suitable for classes of nonswimmers. Some 50-meter pools incorporate movable bulkheads, which permit greater flexibility in the use of the facility.

If the program design does not include competitive swimming, the pool sizes and shapes recommended above are still desirable because they are the most functional.

The multiple-unit aquatic facility is most desirable and may include an instructional pool, a diving well, and a competitive pool. If only one pool is to be built, its multipurpose character will have to meet the needs of the program design as fully as possible.

From the standpoint of flexibility, if the program is broadly conceived, it may be desirable to build pools that can be used for coeducational or all-male and all-female groups. All aquatic facilities should be designed so as to meet the structural regulations of the National Association for Girls and Women in Sport (AAHPER), the National Collegiate Athletic Association, and the Amateur Athletic Union.

The Program

The pool planning committee should carefully review the program requirements before attempting to determine the kinds of aquatic facilities needed. The list below suggests program possibilities, which may aid planning groups in the development of aquatic programs.

- Classes for students in swimming, diving, lifesaving and water safety, synchronized swimming, and skin and scuba diving
- Special classes for the disabled, postoperative cases, excessively timid nonswimmers, and slow learners, and for adapted physical education classes
- Recreational swimming periods for students and faculty
- Make-up swimming periods for students who have had excused absences
- Practice periods for intramural and varsity swimming team groups
- Practice periods for team diving groups
- Practice periods for synchronized swimming club groups
- Boating and canoeing classes
- Assignments for home team competitive meets, water shows, demonstrations, clinics, and other special events
- Classes for faculty children
- Programs for the community.

Location of Specialized Areas

The indoor instructional pool should be located in the aquatic area adjacent to the diving well and competitive pool, but separated from them by a permanent wall. It should be located conveniently in terms of shower rooms, locker rooms, toilet rooms, lavatories, and classrooms.

The indoor competitive pool should be at ground level, with convenient spectator access to corridors and exits so that audiences may come and go without traversing the rest of the building. This pool should be adjacent to dressing rooms, toilet rooms, locker rooms, classrooms, and the instructional pool.

The indoor diving well should be in the same room as the competitive pool, but separated from it by means of a wide deck, parallel to the width of the competitive pool.

Recommended Features

GENERAL RECOMMENDATIONS

- Rectangular shape for pools
- Covered corners to facilitate vacuuming
- Acoustically treated ceilings and walls
- Central office equipped with one-way observation window overlooking all areas
- Entrance to office from outside corridor not in general student traffic lanes
- Recessed ladders, two on each side of each pool, three feet from end walls, three steps maximum, seven to ten inches between steps
- Drinking fountains in each area
- Self-flushing phlegm receptacles on the wall in each area
- Hot and cold water outlets in each area for scrubbers
- Nonskid deck material
- Telephone beside diving well and at one end of each pool, located five feet above deck level
- Cutoff system for hourly bell schedule when meets and shows are in progress
- Yardage markings every five yards on pool sides or decks at water edge
- Bulletin board, 10 by 20 feet in each pool area
- Electric clock in each area
- Underwater window, or windows, on sides of each pool, 10 feet from the deep end and with the top of the window 3.5 feet beneath the surface of the water (a four-by-four-foot window is minimum although larger installations may be desirable)
- Built-in or portable vacuum-cleaning system
- Depth markings on sides or ends of all pools
- Routing for swimmers from the locker and dressing rooms to toilets, showers, suiting area, and then to the pools
- Adequate deck space ranging from 6 to 20 feet (The area behind diving installations should be adequate for safe traffic circulation. Maximum deck space of 20 feet is desirable if construction costs permit.)
- Entire area free of obstructing posts and pillars
- Recessed receptacles for lane lines and floor installations, such as starting blocks and turn pennants for back strokers.

ADDITIONAL FEATURES RECOMMENDED FOR COMPETITIVE POOLS

- Minimum size: 45 by 75 feet, 1 inch
- Depths: 3.5 to 7 feet if no diving boards are installed
  3.5 to 12 feet if boards are installed
- Lanes seven feet wide, with 12-inch lines down the center on the bottom of each lane (Use color that contrasts with pool floor. These lines should end with a "T" of 30 by 12 inches, five feet from each end of the pool.)
- Hand grips, flush with the end of the pool, in the center of each lane for backstroke starts
- Turn targets 30 inches square, built or painted into the end wall in the center of each lane (An abrasive material or paint is recommended. The color selected should

contrast with the pool wall.)

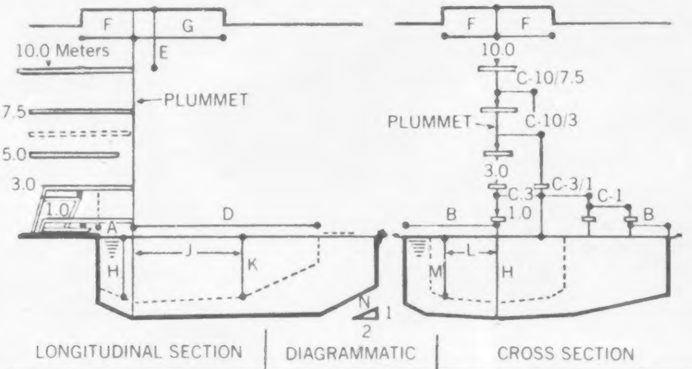
- Adequate clear wall space for mounting scoreboards and record boards
- Large double door with flush threshold, leading to a loading area or driveway for delivery of heavy or large equipment
- Floor or wall fixtures for pennant lines 15 feet from each end of the pool, which permit pennants to hang at regulation height for visibility by backstroke swimmers coming into their turns.

ADDITIONAL FEATURES RECOMMENDED FOR INSTRUCTIONAL POOLS

- Minimum size: 45 by 75 feet, 1 inch
- Depths: 3.5 to 12 feet if diving boards are installed
  3.5 to 7 feet if no boards are installed
- Water-polo markings at each end of pool (consult rule book for regulations)
- Recessed receptacles for water-polo goals on ends of pool, or overhead installations that can be raised and lowered
- A large pegboard of marine plywood or plastic for pegging scenery design for water shows
- Hooks or pulley installations at or near the ceiling or one wall for handling backdrops for water shows.

ADDITIONAL FEATURES RECOMMENDED FOR DIVING POOLS

- Minimum size: 45 by 36 feet
- Separate from competitive pool, but in the same room
- Depth: 14 to 16 feet to accommodate three-meter boards and platforms
- Ceiling height of 15 feet above highest board, or 10 feet above platform
- Water surface agitator in front of each board
- One- and three-meter boards and platforms installed to meet competitive regulations (See Figure 1 and DGWS, NCAA, and AAU references at end of chapter. Platforms may be installed on pillars or hung from the ceiling.)
- Boards installed 10 feet apart (use center of board to measure distance) along one wall, 10 feet from sidewalls
- Diving-board stands, ladders, and fixtures of noncor-



MINIMUM STANDARD DIVING FACILITY DIMENSIONS Adoption by NCAA in 1969		1-METER SPRINGB'D 16'x1'-8''		3-METER SPRINGB'D 16'x1'-8''		INTER-MED PLATFORM 16'x5'		7½-METER PLATFORM 18'x 6'		10-METER PLATFORM 20'x6'6''	
		DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH
A	FROM PLUMMET: BACK TO POOL WALL	A-1 6'	—	A-3 6'	—	A-INT 5'	—	A-7.5 5'	—	A-10 6'	—
	BACK TO PLATFORM DIRECTLY BELOW	—	—	—	—	—	—	5'	—	5'	—
B	FROM PLUMMET TO POOL WALL AT SIDE	B-1 10'	—	B-3 12'	—	B-INT 14'	—	B-7.5 15'	—	B-10 17'	—
C	FROM PLUMMET TO ADJACENT PLUMMET	C-1 8'		C-3 8'	C-3/1 10'	C-INT		C-7.5	C10/7.5	C-10	C-10/3 12'
D	FROM PLUMMET TO POOL WALL AHEAD	D-1 29'	—	D-3 34'	—	D-INT 34'	—	D-7.5 36'	—	D-10 45'	—
E	ON PLUMMET, FROM BOARD TO CEILING OVERHEAD	E-1 16'	—	E-3 16'	—	E-INT 10'	—	E-7.5 10'6''	—	E-10 11'	—
F E	CLEAR OVERHEAD, BEHIND AND EACH SIDE OF PLUMMET	F-1 8'	E-1 16'	F-3 8'	E-3 16'	F-INT 9'	E-INT 12'	F-7.5 9'	E-7.5 12'	F-10 16'	E-10 12'
G	CLEAR OVERHEAD, AHEAD OF PLUMMET	G-1 16'	E-1 16'	G-3 16'	E-3 16'	G-INT 16'	E-INT 12'	G-7.5 16'	E-7.5 12'	G-10 20'	E-10 12'
H	DEPTH OF WATER AT PLUMMET	—	H-1 12'	—	H-3 13'	—	H-INT 14'	—	H-7.5 15'	—	H-10 17'
J-K	DISTANCE, AND DEPTH OF WATER, AHEAD OF PLUMMET	J-1 20'	K-1 10'9''	J-3 20'	K-3 11'9''	J-INT 20'	K-INT 11'9''	J-7.5 26'	K-7.5 13'	J-10 40'	K-10 14'
L-M	DISTANCE, AND DEPTH OF WATER, EACH SIDE OF PLUMMET	L-1 8'	M-1 12'	L-3 10'	M-3 11'9''	L-INT 12'	M-INT 11'9''	L-7.5 13'	M-7.5 11'9''	L-10 14'	M-10 14'
N	MAXIMUM RATIO, VERTICAL TO HORIZONTAL, OF SLOPE TO REDUCE DEPTH: 1:2	1:2		1:2		1:2		1:2		1:2	

Figure 1. Diving Facilities.

rosive metal treated to prevent electrolysis

- Guard rails on all ladders and platforms above one meter in height
- Ladders three feet from pool ends, built into sidewalls.

Recirculation and Filtration System

All modern pools are equipped with a recirculation and filtration system. Filters fall into two general classes: granular media (sand-and-gravel) and diatomaceous-earth or filter-aid. Most granular-media filters for swimming pools are of the pressure-system type, while diatomaceous-earth units can be either pressure-system or vacuum-system. The flow in these systems can be reduced to the simple schematic diagram shown in Figure 2.

Each system includes a pump for moving the water and piping to take the water from the pool and pass it through the filter and treatment units before returning it to the pool. Sterilizing and water-treatment additives are usually introduced in the return piping. Local and state sanitary codes should be consulted for requirements.

In the granular-media system, water impurities are held on top of the media bed (sand, anthrafilt, calcite, ground blast-furnace slag, expanded shale, ground cinder, or similar material). A coagulant (floc) may be used to remove extremely small particles. The system is cleaned by reversing the flow and backwashing the bed.

Diatomaceous-earth and/or filter-aid filters remove water impurities as the flow passes through a thin layer of diatomaceous earth or other filter aid covering the filter elements. When the filter elements have become plugged with impurities and can no longer pass adequate water volume, the filter is cleaned by a backwash or by sluicing of the elements until they are entirely clean. A fresh layer (precoat) of diatomaceous earth is then placed on the elements, and the filter is returned to service. During the filter cycle, the element coating is kept porous and is prevented from early plugging, i.e., "short cycles," by the continuous addition of slight amounts of diatomaceous-earth slurry, also known as body coat.

Construction Materials

Every pool shell is a foundation structure, with water on the inside and sometimes on the outside, too. In designing the pool shell, the particular soil mechanics must be thoroughly investigated. Borings, at least two at the shallow end and two at the deep end, provide vital reference information.

An experienced soil-investigation service should be engaged. Certified logs should show changes of stratum, spoon and casing blows at five-foot intervals, the water table, the rock-core recovery, and all irregularities of the natural formations. The profile of the pool will determine the specifications for materials, construction, and reinforcement of the wall.

When unstable or unsuitable conditions for ground-level installation require the construction of pools above the existing grade, concrete or metal pool shells supported on a suitable structural framework should be considered. For concrete buildings, pools using concrete support beams and integral-formed pool bottoms are usually advantageous. In an all-steel building, structural steel fabrication has advantages.

In-the-ground pools have been developed using many construction materials and techniques for the shell construction, including poured reinforced concrete; pneumatically-applied concrete; carbon steel; aluminum; and brick or concrete-block wall, poured concrete bottom. All are finished with a light-colored paint or ceramic tile.

Pool Shell Equipment

GUTTERS AND SKIMMERS

Pools use gutter systems and skimmers for removing surface water. Gutter designs include roll-out, recessed, and semirecessed. Architects, pool consultants, health officials, and swimming coaches should be consulted in determining what is best suited for the particular installation.

INLETS

Pool water is returned at different locations through connections in the pool shell. Inlets can be set either in the wall or on the pool floor. The use of floor inlets normally results in better pool hydraulics and a self-cleaning action. Local and state codes should be consulted for requirements.

DRAINS

Drains are devices located at the pool bottom for the collection of deep-end water and for emptying the pool. Usually, a removable grate is set in a frame, flush with the bottom of the pool and firmly secured in place so that it cannot be removed by swimmers.

Main drains are also used as pool-water returns, similar to an inlet, and styles to accommodate these systems are available. Perforated drains are desirable for safety. Drains should never be located below the diving trajectory. Local codes set standards for the sizes of drains.

HYDROSTATIC RELIEF VALVES

Hydrostatic relief valves can be the most important shell equipment provided. Every pool, when empty, is essentially a boat hull. Water beneath the hull tends to cause the pool to float. Hydrostatic relief valves relieve external water pressure on the pool shell.

ALARM SYSTEMS

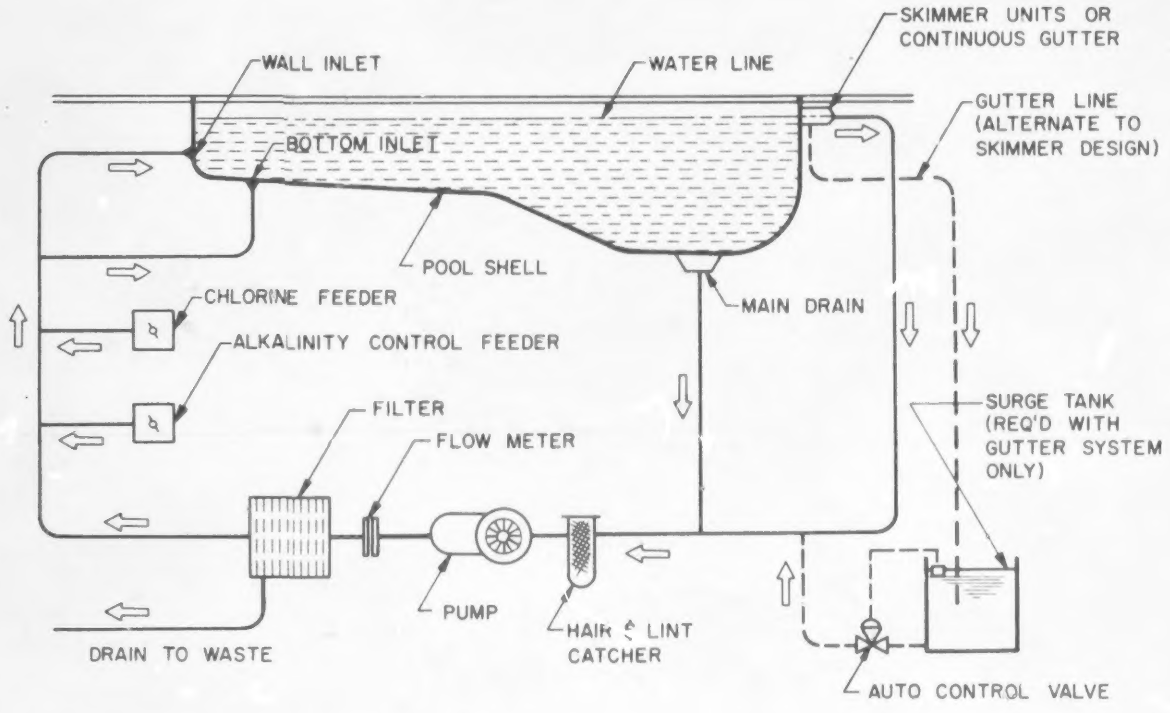
Alarm systems for indicating the presence of persons in the water when the pool is closed and unsupervised can perform an important watchman service. Troubles with early models are being corrected, and practical systems are now available.

ILLUMINATION SYSTEMS

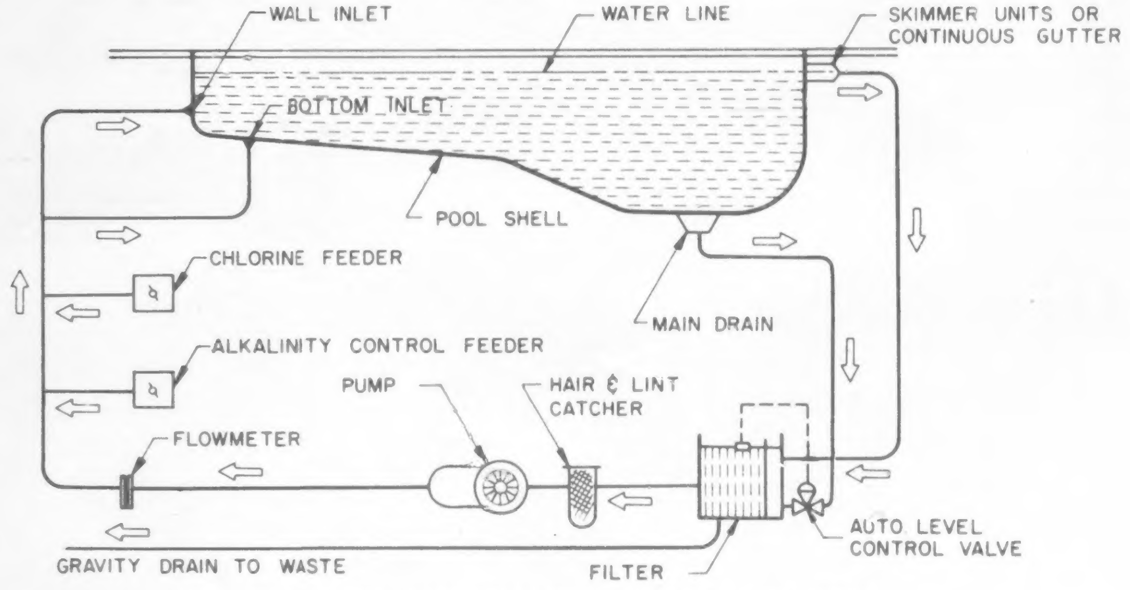
Underwater lighting must be installed in accordance with the requirements of local authorities. This information should be obtained early in the design-program planning stage. If underwater lighting is used, it should be grounded to the cold-water system, and a qualified electrical engineer should check the effectiveness of the installation. Water volume has a great influence on lighting levels throughout the pool shell.

Attention to the spacing of underwater light units is needed. The Illuminating Engineering Society recommendation yields good results, although what appears to be needed is a volumetric basis of calculation similar to the "zonal cavity" computations being introduced to the profession.

White lighting, containing a light tinge of blue, has been used successfully for night lighting. For pools that are lighted at night, amber lighting has proved most effective in minimizing insect attraction. Other colors reduce the


SKIMMER UNITS OR CONTINUOUS GUTTER
WALL INLET
WATER LINE
GUTTER LINE (ALTERNATE TO SKIMMER DESIGN)
BOTTOM INLET
POOL SHELL
CHLORINE FEEDER
MAIN DRAIN
ALKALINITY CONTROL FEEDER
FILTER
SURGE TANK (REQ'D WITH GUTTER SYSTEM ONLY)
FLOW METER
PUMP
HAIR & LINT CATCHER
DRAIN TO WASTE
AUTO CONTROL VALVE

GRANULAR MEDIA AND PRESSURE DIATOMACEOUS EARTH FILTERS


WALL INLET
WATER LINE
SKIMMER UNITS OR CONTINUOUS GUTTER
BOTTOM INLET
POOL SHELL
CHLORINE FEEDER
MAIN DRAIN
ALKALINITY CONTROL FEEDER
PUMP
HAIR & LINT CATCHER
FLOWMETER
AUTO LEVEL CONTROL VALVE
GRAVITY DRAIN TO WASTE
FILTER

VACUUM TYPE DIATOMACEOUS EARTH FILTERS

NOTE: POOL OVERFLOW & VACUUM LINES HAVE BEEN OMITTED FROM ABOVE SCHEMATICS FOR CLARITY.

PREPARED BY
MILTON COSTELLO, CONSULTING ENGINEER
WANTAGH, NEW YORK 11794

Figure 2. Typical Pool Hydraulic Schematics.

transmission of light to a serious extent and cause the swimmers to look garish. Area lighting should be designed by a lighting specialist.

Excessive source glare can be prevented by a sufficient number of fixture locations. Mounting height for fixtures should be at least 30 feet for uniform comfort levels and glare reduction.

Colored spotlights can be used effectively for architectural interest and for highlighting the diving tower, starting blocks, ladder locations, walls, and other areas.

Infrared heating lamps and quartzline heating fixtures, in addition to providing light, can be used effectively for projecting radiant heat to ensure extra comfort at principal activity locations.

CONTROL OF AIR CIRCULATION

In all pool areas, the plan for control of air circulation should provide for heating and cooling cycles to allow for an orderly release of heat from the body of the swimmer so that there will be no draft sensations.

ELECTRICAL OUTLETS

Multiple electrical outlets should be installed on the sides and ends of all pool areas, three to four feet above deck level. The weatherproof, outdoor type, grounded for safety, is recommended.

DECK DRAINS

In all pool areas, deck drains should slope away from the pool toward the center of the deck or outside wall. Local and state sanitary codes should be consulted for requirements.

Storage

A storage room should be accessible from the pool deck. This room should be constructed to meet the needs of the program and should relate to the specific facilities. It should be equipped with double doors and flush thresholds and should contain no obstructing pillars or inconvenient cul-de-sacs. A room with minimum dimensions of 20 by 40 feet will provide space to accommodate canoes and other large pieces of equipment used in the aquatic program.

Location Of Mechanical Installations

Below the aquatic wing, a tunnel should lead to all plumbing, which should be exposed to facilitate future repairs and maintenance. This tunnel should also permit access to the underwater windows. Separate and oversized filters, pumps, and heaters for each unit will increase the life of the installation. Separate thermostats connected to influent water pipes should be installed in each unit.

ADDITIONAL REQUIREMENTS FOR OUTDOOR POOLS

Location

Outdoor pools should be conveniently located in relation to other facilities for athletics, physical education, and recreation. Locations in natural valleys, basins, or depressions in the terrain should be avoided. Relatively dry subsurface conditions are recommended for outdoor pool installations. Locations adjacent to wooded areas, industrial plants, main traffic areas, or other possible sources of pool contamination should also be avoided.

Design

The same design considerations are desirable for outdoor as for indoor pools, except that larger installations are frequently constructed outdoors.

Deck space for outdoor pools should be at least twice the square footage of the surface of the water. It is recommended that consideration be given to the development of a dry deck area for sunbathers.

Features and Facilities

WINDBREAKS

The structures housing the dressing facilities, showers, office, and mechanical equipment should be located to form a windbreak for the pool area in situations where the prevailing wind may interfere with swimmer comfort. Plastic or canvas may be hung on the fence for additional windbreaks if required in a specific situation.

WATER HEATING

In temperate and colder climates, provision for heating the pool water will extend the annual period of pool use.

POOL COATING

The interior surface of the pool should be finished with a smooth coating that both can be kept clean and will provide traction for safe walking in shallow water.

FENCING

Outdoor-pool installations must be completely enclosed by a fence at least seven feet high. Local and state codes should be consulted.

DIVING FACILITIES

Diving facilities depend upon the type of outdoor installation. If at all feasible, the construction of a separate diving well is advocated. Boards and platforms should be mounted so that the diver faces south or east. Diving platforms add to the flexibility of the facility, and their specifications should conform to official AAU and/or Olympic requirements for competition. Appropriate rule books should be consulted for details.

STEPS

Steps at the shallow end are useful in outdoor pools. They should be set back into the wall, and the treads should be of contrasting color and finished with nonskid paint or other nonslippery material. Handrails are desirable for use by disabled and older swimmers.

LANES

Competitive lanes for outdoor pools must be eight feet in width.

ENTRANCES AND EXITS

Entrances and exits, located at the shallow end of the pool, are recommended for control of traffic and ease of supervision.

MECHANICAL EQUIPMENT

Filters, pumps, and other mechanical elements for the outdoor pool must have sufficient capacity to take care of the extra demands caused by contamination elements, algae, and the more rapid chlorine fade-out that occurs in the presence of sunlight.

The Outdoor Pool as Part of A Recreation Complex

Outdoor swimming areas may be planned as part of a recreation complex. In this situation, consideration should be given to swimming facilities for children. Separate wading pools or increased shallow water areas in the regular pools may be considered.

Where the pool depth ranges between 3.5 and 4 feet, the shallow-water area can be increased to two-thirds of the pool length. If a wading pool is installed, the water depth should range from 8 to 24 inches, and the pool should be fenced and separately controlled for safety.

Spectator Seating

Bleacher-style spectator sections are needed when water shows and competitive meets are held in outdoor pools. Such seating may be permanent or portable, depending upon the needs of the particular institution. The stands should parallel the length of the competitive course and be placed so spectators' backs will be to the afternoon sun.

Sound Systems

Public-address systems, record players, and underwater speakers are desirable additions to outdoor installations. Care must be taken to place speakers and the microphone inputs strategically around the pool area. It is unsafe to extend electrical cables around pool decks in proximity to moisture.

Lifeguard Stands

Large outdoor pools require careful study to determine correct placement of lifeguard stands for good visibility under peak-load conditions.

Local and state codes should be consulted for specific safety regulations.

CHECK LIST FOR PLANNERS OF SWIMMING POOLS

1. Has a clear-cut statement been prepared on the nature and scope of the design program and the special requirements for space, equipment, and facilities dictated by the activities to be conducted?
2. Has the swimming pool been planned to meet the total requirements of the program to be conducted as well as any special needs of the clientele to be served?
3. Have all plans and specifications been checked and approved by the local board of health?
4. Is the pool the proper depth to accommodate the various age groups and types of activities it is intended to serve?
5. Does the design of the pool incorporate the most current knowledge and best experience available regarding swimming pools?
6. If a local architect or engineer who is inexperienced in pool construction is employed, has an experienced pool consultant, architect, or engineer been called in to advise on design and equipment?
7. Is there adequate deep water for diving (minimum of 9 feet for one-meter boards; 12 feet for three-meter boards, and 15 feet for 10-meter towers)?
8. Have the requirements for competitive swimming been met (seven-foot lanes; 12-inch black or brown lines on the bottom; pool one inch longer than official measurement; depth and distance markings)?
9. Is there adequate deck space around the pool? Has more space been provided than that indicated by the minimum recommended deck/pool ratio?
10. Does the swimming instructor's office face the pool? Is there a window through which the instructor may view all the pool area? Is there a toilet-shower-dressing area next to the office for instructors?
11. Are recessed steps or removable ladders located on the walls so as not to interfere with competitive swimming turns?
12. Does a properly constructed overflow gutter extend around the pool perimeter?
13. Where skimmers are used, have they been properly located so that they are not on walls where competitive swimming is to be conducted?
14. Have separate storage spaces been allocated for maintenance and instructional equipment?
15. Has the area for spectators been properly separated from the pool area?
16. Have all diving standards and lifeguard chairs been propely anchored?
17. Does the pool layout provide the most efficient control of swimmers from showers and locker rooms to the pool? Are toilet facilities provided for wet swimmers separate from the dry area?
18. Is the recirculation pump located below the water level?
19. Is there easy vertical access to the filter room for both people and material (stairway if required)?
20. Has the proper pitch to drains been allowed in the pool, on the pool deck, in the overflow gutter, and on the floor of shower and dressing rooms?
21. Has adequate space been allowed between diving boards and between the diving boards and sidewalls?
22. Is there adequate provision for lifesaving equipment? Pool cleaning equipment?
23. Are inlets and outlets adequate in number and located so as to ensure effective circulation of water in the pool?
24. Has consideration been given to underwater lights, underwater observation windows, and underwater speakers?
25. Is there a coping around the edge of the pool?
26. Has a pool heater been considered in northern climates?
27. Have underwater lights in end racing walls been located deep enough and directly below surface lane anchors, and are they on a separate circuit?
28. Has the plan been considered from the standpoint of handicapped persons(e.g., is there a gate adjacent to the turnstiles)?
29. Is seating for swimmers provided on the deck?
30. Has the recirculation-filtration system been designed to meet the anticipated future bathing load?
31. Has the gas chlorinator (if used) been placed in a separate room accessible from and vented to the outside?
32. Has the gutter waste water been valved to return to the filters, and also for direct waste?

INDOOR POOLS

1. Is there proper ventilation?
2. Is there adequate acoustic treatment of walls and ceilings?
3. Is there adequate overhead clearance for diving (15 feet above low springboards, 15 feet for three-meter boards, and 10 feet for 10-meter platforms)?
4. Is there adequate lighting (50 footcandles minimum)?
5. Has reflection of light from the outside been kept to the minimum by proper location of windows or skylights? (Windows on sidewalls are not desirable.)
6. Are all wall bases coved to facilitate cleaning?
7. Is there provision for proper temperature control in the pool room for both water and air?
8. Can the humidity of the pool room be controlled?
9. Is the wall and ceiling insulation adequate to prevent "sweating"?
10. Are all metal fittings of noncorrosive material?
11. Is there a tunnel around the outside of the pool or a trench on the deck permitting ready access to pipes?

OUTDOOR POOLS

1. Is the site for the pool in the best possible location (away from railroad tracks, heavy industry, trees, and dusty open fields)?
2. Have sand and grass been kept the proper distance away from the pool to prevent them from being transmitted to the pool?
3. Has a fence been placed around the pool to assure safety when not in use?
4. Has proper subsurface drainage been provided?
5. Is there adequate deck surface for sunbathing?
6. Are the outdoor lights placed far enough from the pool to prevent insects from dropping into the pool?
7. Is the deck of nonslip material?
8. Is there an area set aside for eating, separated from the pool deck?
9. Is the bathhouse properly located, with the entrance to the pool leading to the shallow end?
10. If the pool shell contains a concrete finish, has the length of the pool been increased by three inches over the "official" size in order to permit eventual tiling of the basin without making the pool too short?

11. Are there other recreational facilities nearby for the convenience and enjoyment of swimmers? ______
12. Do diving boards or platforms face north or east? ______
13. Are lifeguard stands provided and properly located? ______
14. Has adequate parking space been provided and properly located? ______
15. Is the pool oriented correctly in relation to the sun? ______
16. Have windshields been provided in situations where heavy winds prevail? ______

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APPENDIX 1

Accessibility: The characteristic of facilities conveniently available to those whom they were designed to accommodate.

Accommodation: The process by which the eye changes from one distance to another.

Acoustics: The science of heard sound, including its production, transmission, and effects; the qualities of a room that have to do with how clearly sounds can be heard or transmitted in it.

Adapted Activities: Recreational events adjusted to fit the needs, interests, and capabilities of the physically and/or mentally handicapped.

Adhesive: A substance that causes bodies to adhere to each other.

After Image: A visual response that occurs after the stimulus causing it has ceased.

Aggregate: Any hard material (usually sand and rock) for mixing in graduated fragments with a cementing material to form concrete, plaster, or the like.

Aging: Those manifestations of the aging processes that significantly reduce mobility to perform either physical or mental tasks but are not accounted for in other categories.

Aims: Remote goals that guide thoughts and actions.

Angle of Reflection: The angle between the reflected ray and the normal or perpendicular to the point of reflection.

Angle of Refraction: The angle between the refracted ray and the normal or perpendicular drawn to the point of refraction.

Annunciator: An electrically controlled signal board or station on which is indicated, usually by lights or a dropping shutter, which of the connecting lines is calling.

Apparatus: A collection or set of devices designed to contribute to physical development by providing opportunities for climbing, swinging, balancing, and performing gymnastic stunts.

Appraisal Survey: A method of evaluating the existing community recreation or school resources, program, and services in accordance with some established standards or criteria.

Aquatics: Sports performed in or upon the water.

Arts and Crafts: Activities that serve as outlets for creative expression and provide opportunities to find satisfaction through making things with the hands, such as carving, modeling, weaving, painting, sewing, and photography.

Asbestos: A grayish mineral; a silicate of calcium and magnesium that occurs in long, threadlike fibers; because it does not burn and is a nonconductor of electricity, it is used in fireproof curtains, roofing, and insulation.

Asphalt: A brown or black solid bituminous substance obtained largely as a residue from certain petroleums and which is insoluble in water. It is used for paving, roofing, in paints and varnishes, and in combination with other materials for floor tile.

Astragals: A small convex moulding of rounded surface, generally from half to three-quarters of a circle; a strip of moulding on the edge of folding doors.

Athletic Field: A specialized type of outdoor recreational area intended primarily for highly organized games and sports, such as football, track, and baseball. Permanent seating facilities are usually provided, and the area is often enclosed by a fence or wall. Athletic fields equipped with permanent seating facilities are referred to as stadiums.

Athletics: Sport activities based on organized competition, requiring a set of rules and a code of ethics, a high degree of skill, conditioning, and training. Examples of athletic contests are college football games, high school basketball games, Amateur Athletic Union track-and-field meets, and intracommunity softball games.

Attractiveness: Aesthetic appeal; beauty in terms of intended purpose.

Auxiliary: An additional, supplementary facility used to supplement the main facility.

Bathing Beach: A tract of land adjoining a lake, stream, or ocean. Facilities provided usually include a bathhouse, playground apparatus, picnic areas, courts for games, and space for parking.

Batten: A strip of wood put over a seam between boards as a fastening or covering.

Beam: Several nearly parallel rays of light; a long, thick piece of wood, metal, or stone used on buildings.

Berm (or Dike): A narrow shelf, path, or ledge, as along the top of a scarp or along a road.

Beveled: Sloping part of the surface; to slope at an angle.

Blinding Glare: Glare so intense that for an appreciable period of time no object can be seen.

Brightness: Luminous intensity created by direct emission of light from a source by transmission through a translucent medium or by reflection from a surface. The unit of brightness is the footlambert.

Brightness Balance: Specified limitations of brightness differences and brightness ratios within the visual fields which, if observed, will contribute toward visual comfort and good visual performance.

Brightness Contrast: The relationship between the brightness of an object and its immediate background.

Brightness Difference: The difference in brightness among the various reflecting surfaces and light sources within the total visual field as measured in footlamberts.

Brightness Ratio: The ratio of two brightnesses in the field of view.

British Thermal Unit: The quantity of heat (252 calories) required to raise the temperature of one pound of water one degree Fahrenheit at or near its point of maximum density (62° to 63°).

Bulkhead: An upright partition separating two parts in protection against fire or leakage, as a wall or embankment holding back earth, fire, or water.

Candlepower: Luminous intensity expressed in candelas (formerly, candles).

Casing: The act or process of encasing a frame, as of a window or a door.

Caulking: A filler for seams or cracks.

Chair Rail: An encircling band on the walls around the room at chair height to protect walls from damage by chairs contacting them.

Chamfer: The surface formed by cutting away the angle formed by two faces of timber, stone, or metal; to furrow; to channel; to flute; to bevel.

Chlorinate: To combine chlorine with water for purification.

Circuit Breaker: A device that automatically interrupts the flow of an electric current.

Climate Control: A term used to include the control of heating, ventilating, and air-conditioning.

Color: A property of light that depends upon its wave length or frequency; any one of the hues of the spectrum.

Color Discrimination: The perception of differences between two or more colors.

Community: A small city or a section of a larger city, primarily a residential area usually composing three to five neighborhoods, representing the service area of a secondary school and containing a business center. The people are held together by psychological, sociological, and economic bonds and may act together consciously or unconsciously in their chief concerns of life. The community creates, as a result of its common interests, certain institutions of legal, protective, educational, economic, recreational, and religious character. A community includes factors of interdependence and belonging and a sense of usefulness through contributing to the common good.

Community Recreational Center: A structure devoted exclusively or primarily to a diversified program of community recreational activities. Such features as a gymnasium, club rooms, social hall, craft rooms, game rooms, kitchen, auditorium, lobby, and service facilities are usually provided. The term "neighborhood center" is often used to describe a recreational center that serves a specific neighborhood.

Competition: Activity involving conscious or unconscious rivalry, in which one person or group tries to gain advantage over the other person or group; involvement of two or more opponents in a contest. This term can also mean rivalry with a previous record of an individual or group. Competition can occur without conflict, as in a friendly game of cards.

Complementary Colors: A pair of contrasting colors which, when mixed in proper proportions, give a neutral color or grey.

Comprehensive Survey: A study that provides an extensive, thorough investigation and analysis of the leisure and recreational pattern of a given locality. It includes an investigation of social, political, economic, and cultural causal relationships that have affected, are affecting, or seemingly will affect the future leisure and recreational services in a specific locality.

Concession: Authority, granted under contract with mutually acceptable provisions by all parties concerned, given by recreation departments to operators permitting them to provide services and/or to sell commodities to patrons of recreational areas and facilities.

Condemnation: To pass an adverse judgment on; disapprove of strongly; censure; to prove guilty of wrong-doing; to declare unfit for service or use; to condemn private property for public use; the processes by which government exercises its rights of eminent domain.

Condenser: That which makes dense, concentrates, or compresses.

Convector: A medium of convection; the transmission of heat or electricity by the mass movement of the heated or electrified particles, such as air, gas, or liquid currents.

Co-recreation: Activities engaged in jointly by both sexes, such as dances, mixed choruses, and hiking.

Cove: A large hollow forming part of an arch in sections joining the walls and floor, or the walls and ceiling of a room.

Creative Recreation: Activities that provide opportunity for production, formation, origination, making new things, or remodeling old things; an outlet for one's creative urge. Arts and crafts, dance, drama, and music are examples of creative recreation.

Crowned Field: A curved field with the summit or highest point (crown) at the middle, running lengthwise. (A football field is crowned for the purpose of drainage.)

Dado: A term applied to the lower portion of walls when decorated separately.

Day Camping: A group experience in the natural environment under trained leadership requiring that the campers be absent from home only during daylight hours.

Deck: A platform or floor, such as a ship's deck or a swimming-pool deck.

Design: The architectural form, pattern, or scheme of construction of athletic, physical education, or recreational areas, facilities, and their units.

Diatomaceous: Containing or consisting of diatoms or their fossils (a number of related microscopic algae, one-celled or in colonies, whose walls consist of two parts or valves and contain silica).

Discomfort Glare: Glare that produces discomfort; it does not necessarily interfere with visual performance or visibility.

District: A large geographical planning unit of a large city, comprising a number of communities.

Drama Recreation: Activities that give form and order to theatrical impulses; such activities include the imaginative play of children, charades, pageants, and plays.

Driver and Traffic-Safety Education: Learning experiences provided by the school for the purpose of assisting students to become good traffic citizens and to operate motor vehicles efficiently and safely.

Driving Simulator: A teaching technique utilizing both films and electromechanical devices designed to simulate the driver's compartment of an automobile, to help students develop proper judgment, behavioral responses, and manipulative skills.

Dual-Control Car: A car equipped with an extra foot brake (for instructor) for automatic transmissions, and an extra clutch and brake pedal for conventional transmissions.

Easement: A right or privilege that a person may have on another's land, as the right-of-way.

Eaves: The lower part of a roof protecting beyond the face of the wall.

Economy: Costs kept at a minimum compatible with program needs, durability of materials, low maintenance, and attractiveness.

Elevation: A geometrical projection on a plane perpendicular to the horizon; an elevated place; the distance above or below the zero level or ground level.

Eminent Domain: The legal right of federal, state, and local governments to take any property required for public purpose. The right implies that the land must be taken by due process of law and that the owner from whom the land is taken receives reasonable compensation.

Environment: The aggregate of all the external conditions, surroundings, and influences affecting the place or individual.

Equipment: Movable furnishings as opposed to stationary property; relatively permanent articles, furnishings, machinery, and devices used in administering, operating, and maintaining recreational programs and services.

Escutcheon: A shield or plate, as around a keyhole.

Experience: An actual and conscious living through an event, or events, as they occur; anything observed or lived through.

Extrude: To thrust out; to push out or force out; expel; to stick out; protrude; project.

acade: The face or elevation of a building.

acilities: Areas, structures, and fixtures essential to accommodate the program.

Familiarization: Programs acquainting the user, as with the water when teaching swimming.

Fascia: A wooden or stone band between moldings.

Fenestration: Windows and all other sources and means of control of natural light.

Field House: A facility providing enclosed and unobstructed space adaptable to various physical education and recreational activities, services, demonstrations, and meetings. It is often located on, or near, a playfield or athletic field. The term also refers to a service building used by people using the athletic field.

Fixed Turning, Radius, Wheel to Wheel: The tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot.

Fixture: Something firmly attached, as a part or an appendage, such as a light fixture; equipment affixed to the surface of a building in such a manner that its removal would deface or mar the surface. (Legally, it is the property of the building.)

Flashing: Sheets of metal or other material used to waterproof joints and cages, especially of a roof.

Flexibility: Increase or decrease in kind and amount of use at reasonable cost and effort; a quality of elasticity of the muscles and the connecting tissues in the body.

Flush: Unbroken or even in surface; on a level with the adjacent surfaces; having no indentation.

Fluting: The vertical channeling on the shaft of a column.

Footcandle: The illumination at a point on a surface that is one foot from and perpendicular to a uniform point source of one candela (candle); a lighting term used to denote quantity.

Footlambert: A unit of brightness of a surface or of a light source. One footlambert equals one lumen per square foot. Candelas (candles) per square inch is an optional term for a unit of brightness of a light source. One candela (candle) per square inch equals 452 footlamberts. The candela per square meter is the metric term and will be used more in the future. For "brightness" we now say "luminance (photometric brightness)."

Foot-pound: A unit of energy equal to the amount of energy required to raise a weight of one pound a distance of one foot.

Fulcrum: The support or point of support on which a lever rotates.

Fullers Earth: A clay-like, earthy substance used as a filter medium.

Furring: The leveling of a floor, wall, or ceiling, or the creating of air spaces with thin strips of wood or metal before adding boards or plaster; the act of trimming or lining.

Gable: The triangular portion of a wall, between the enclosing lines of a sloping roof.

Gallery: A communicating passage or wide corridor for pictures and statues; upper story for seats.

Glare: The sensation produced by brightness within the visual field that are sufficiently greater than the brightness to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility.

Glaze: Any impervious material—produced by fire—used to cover the body of a tile to prevent absorption of liquids and gases, to resist abrasion and impact, or to give a more pleasing appearance.

Glazed Tile: A hard, dense tile that has been glazed to prevent absorption, to increase its beauty, or to improve ease of cleaning.

Gradient: The grade or rate of ascent or descent; a rate of increase or decrease of a variable magnitude, or the curve that represents it.

Grid: A framework of parallel bars; a grating.

Gutter: A trough or channel along or under the eaves of a roof to carry off rainwater; also around the upper edge of a swimming pool.

Gymnasium: A building or part of a building devoted primarily to group activities such as basketball, gymnastics, volleyball, and dancing. It is equipped with gymnastic apparatus, a court area for playing athletic and game activities, dressing room facilities, and seating arrangements for spectators.

Gymtorium: A combination facility designed to be used as a gymnasium or auditorium. Other combination facilities are cafetoriums (cafeteria and auditorium) and gymnateria (gymnasium and cafeteria).

Handicapped: A person who has less than normal aptitude and/or ability for performing the ordinary tasks of life, or of a particular vocation or avocation. The usual reference is to a person physically handicapped, i.e., who has a specific anatomical or physiological deficiency (poor vision, hearing), but it may also apply to the mentally deficient, maladjusted, or retarded person.

Header: A wooden beam placed between two long beams with the ends of the short beams resting against it.

Health: A state of optimal physical, mental, and social well-being, and not merely the absence of disease or infirmity.

Hearing Disabilities: Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

Hobby: An engrossing activity to which one frequently reverts and to which he gives his free time, such as stamp collecting, knitting, and gardening.

Hose Bibb: A faucet with the nozzle bent downward and threaded for hose connections.

Humidity: Moisture content of the air expressed in percent of maximum.

Ill and Handicapped: A collective term that includes all those classifications, by authorities, of persons suffering from diseases or disability.

Impulse: Acting briefly and as a result of impulse.

Indoor Center: A building, such as a school, church, or community center, that has the facilities needed to carry on recreational activities.

Instruction: The process of conveying facts or information, ideas, and concepts.

Integral: The result of integrating parts into a whole; necessary for completeness; essential; whole or complete.

Integration: Functional interrelationship; the process of making whole.

Interpretative: Explanatory; a conception of art, writing, program, structure, or concept; used to interpret.

Jamb: A side post of a doorway, window frame, fireplace, etc.

Joint: A place or part where two things or parts are joined together.

Lanai: Hawaiian veranda.

Leadership: The ability of one person, or a group of people, to influence others to recognize goals of common interest and to stimulate them to act cooperatively to achieve these goals.

Leisure: To be permitted; a bulk of time; a state of freedom; a minimum of obligation; a physiological and emotional necessity; identified by "when" rather than "how."

Liability: The responsibility of one who is bound in law and justice to do something that may be forced by action; a condition that gives rise to an obligation to do a particular thing, to be enforced by court action; a responsibility between parties that the courts recognize and enforce; an unintentional breach of legal duty causing reasonably foreseeable damage.

License: A formal permission to do something; a document indicating certain permission; freedom to deviate from strict conduct, rule, or practice; generally may be permitted by common consent.

Light: Visible radiation—generally considered to be the electromagnetic radiations of wave lengths between 380 and 780 nanometers, which are the violet and red ends of the visible spectrum, respectively.

Lintel: The horizontal timber or stone that spans an opening, as over doors or windows.

Louver: An aperture or frame with boards fitted in a slatted panel for ventilation.

Lumen: A unit of output of light source or of a luminaire.

Luminaire: Lighting unit, including lamps.

Maintenance: The keeping of recreational areas, facilities, equipment, and supplies in accordance with established standards and existing needs for effective operation.

Marina: A water dock or basin providing secure moorings for watercraft.

Master Plan for Recreation: A long-term guide for the systematic and orderly selection and development of recreational facilities and services over a given period of time. It might be composed of such elements as goals, organizational structure, activity program, areas, facilities, personnel, and financial support.

Millieu: The total environment and surroundings within which an activity takes place. Milieu is frequently used as synonym for environment.

Mobile Laboratory Unit: A driver-education classroom-laboratory on wheels to accommodate several locations.

Module: A standard or unit of measurement; the length of some part used to determine the proportions of a building.

Monitor: An instrument used for monitoring; a warning; a reminder; a test for intensity of quality.

Monolithic: Massively solid; single and uniform.

Motivation: The process of initiating conscious and purposeful action. It becomes objectified as an interest and usually leads to action in pursuit of that interest. A psychological interpretation is the application of incentives to an individual or group for whom activity is desired. This term is not to be confused with the psychological term "unconscious motivation."

Mullion: A slender, vertical dividing bar between the lights of windows, screens, etc.

Multiple-Car Driving Range: An area in an off-street location where a number of cars are used simultaneously for laboratory instruction under the supervision of one or more instructors.

Multiple-Use Areas and Facilites: Physical features designed and constructed to meet the space and facility requirements of several types of recreational activities. A gymnasium is an example of a multi-use facility—designed to serve more than one purpose.

Natatorium: An indoor aquatic facility.

Negligence: Failure to act with reasonable care or prudent judgment under the circumstances involved.

Neighborhood: A segment of a community composed of a residential area in which the people may have common ethnic, social, and economic characteristics. They are generally served by the same elementary school and recreational center. The neighborhood may be bounded by barriers, such as thoroughfares, railroads, and waterways, and by commercial and industrial developments.

Neighborhood Park: A landscaped area with a more or less formal design intended to provide an attractive neighborhood setting and a place for recreational activities.

Neighborhood Playground: An outdoor play center designed to meet the recreational needs of a neighborhood, especially the children from 6 to 14 years old. Playgrounds are ideally located in the center of a neighborhood. An apparatus area, a playlot, a wading pool, and a shelter house are usually provided.

Nonslip: Having the tread so constructed as to reduce skidding or slipping.

Nonslip Tile: Tile the components of which incorporate certain admixtures such as abrasive granules in the body or the surface.

Nosing: The projecting edge of a step; that part of the tread which extends beyond the riser; a stair nosing.

Objectives: Short-range and realizable goals; goals that are more attainable than remote aims, but less attainable than immediate outcomes; attainable goals that guide one's thoughts and actions.

Observation Gallery: A platform or projecting upper floor attached to the back wall or sides of a room designed to permit seeing, watching, and observing.

Opaque: The quality of being impervious to light.

Open Space: A relatively underdeveloped area provided within or near urban development to minimize feelings of congested living.

Orientation: The directional placement of a facility; establishing position.

Outdoor Center: An area designed to provide the space and facilities needed to carry on outdoor recreational activities.

Outdoor Education: A process—taking place under leadership in natural surroundings—that is in or about the outdoors.

Outdoor Recreation: Any type of recreational activity accomplished in the out-of-doors, such as outdoor band concerts, picnics, outdoor pageants, and outdoor dances. It usually refers to activities performed in the natural environment.

Outdoor Theater: A recreational facility designed to meet the needs for a suitable place to hold outdoor plays, pageants, concerts, and meetings. Outdoor theaters vary in size from those located on a playground to the large community type and are constructed in a natural setting, conforming to the characteristics of the area. Grassy slopes, sodded terraces, cement steps or terraces, or permanent or portable benches serve as seats for the spectators.

Outrigger: Any temporary support extending out from the main structure.

Park: An area permanently dedicated to recreational use and generally characterized by its natural, historic, and landscape features. It is used for both passive and active forms of recreation and may be designed to serve the residents of a neighborhood, community, state, region, or nation.

Park District: A subdivision of state government exercising within its jurisdiction the authority of a municipality. It may operate and maintain parks, recreational programs, police forces, airports, and other such facilities and programs as may be designated in the act establishing the district.

Park-School: An area cooperatively planned by school and municipal authorities to provide programs of education and recreation for day-by-day use by the people of a neighborhood or community.

Parkway: Essentially an elongated park with a road running through it, the use of which is restricted to pleasure traffic. The parkway often serves to connect large units in a park system and is rarely found except in large cities.

Participant: A person not employed by the recreation agency who is taking part in a recreational activity or event promoted by the agency.

Peripheral Field: The portion of the visual field falling outside the central visual field.

Peripheral Vision: Vision outside the central visual field.

Permeable: That which can be permeated; open to passage or penetration, especially by fluids.

Persistence of Vision: Vision persisting after the exciting visual stimulus has been removed.

Physical Education: The science and skill of movement, using all types of sports and physical activities for the following specific purposes: to develop and maintain physical efficiency; to develop useful knowledge and physical skills; to teach students to act in socially useful ways; and to develop skills that may be used for physical recreation.

Pilaster: A rectangular feature in the shape of a pillar, but projecting only one-sixth of its breadth from a wall.

Planning: The development of an organized procedure, including the selection of goals and objectives and the tools of action necessary to carry out these goals. Planning involves taking into consideration the social and physical environment of an area as well as the role that recreation plays in area development.

Platform: A surface that is generally horizontal, flat, and raised, or a philosophical basis for a program of action.

Play: The willful and spontaneous natural expression of people that pervades many of the recreational activities of children and adults.

Playfield: A recreational area designed to serve the needs of a community or neighborhood having a population of 10,000 to 15,000 persons. Its essential features are a community recreational building, areas for sports and games, a playground for children, picnic areas, public parking, and occasionally, a swimming area.

Playground: The basic recreational area in a residential neighborhood, providing a variety of recreation activities for people of all ages, primarily children of 6 to 14.

Playlot: A small area intended primarily for the play of preschool-age children and generally located in the corner of a neighborhood playground or near the center of one or more units of a multiple-family housing development. It is usually equipped with a sandbox, slides, swings, and other playground apparatus. Totlots and playlots are synonymous.

Plaza: A small landscaped area rarely more than a block in size and often consisting of a triangle or circle at a street intersection.

Post Sleeves: Metal pipe, installed at ground level or slightly below, that receives posts to facilitate various activities.

Principle: A guiding rule for the planning, construction, use, or maintenance of a facility in accordance with its intended purpose; a rule of action or conduct; a fundamental rule; an intellectual concept; a guide to the requirements and obligations of right conduct.

Professional: Any practicing, trained, qualified person who makes his living administering, directing, leading, organizing, or planning activities; one who professes or declares openly his sentiments, beliefs, or skills, and offers instructional services therein. The work calls for special preparation, rigorous training, the application of scientific principles, and abiding by a code of ethics.

Proprietary Functions: Those services performed by a municipality, school, county, or other governmental unit for the specific benefit of the inhabitants of that unit in contrast to a benefit of the general public, or which may be conducted in competition with private enterprise.

Prudent: Care, precaution, attentiveness, and good judgment as applied to action or conduct; capable of exercising sound judgment in practical matters; cautious; discreet in conduct; circumspect; sensible; not rash.

Psychophysical Equipment: Laboratory testing devices used to indicate a variety of abilities related to visual acuity, field of vision, distance judgment and depth perception, color vision, night vision, glare vision, glare recovery, reaction time, and steadiness of hand.

Public Relations: The creation of good will through information and education at every point of contact between the agency and its publics; some of the media used to promote good public relations are printed circulars and reports, program demonstrations, employee contacts, newspapers, radio, window displays, and public addresses; harmonious working relationships to inform, to correct misunderstandings, to change opinion, to gain support, to remove apathy, to modify attitude, to establish confidence, to develop awareness of importance of program, and to develop the partnership concept.

Rabbet: A groove or cut made in the edge of a board, etc., in such a way that another piece may be fitted in to form a point.

Ramps, Ramps with Gradients: In this text, ramps with gradients (or ramps with slopes) that deviate from what would otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

Ray: A single line of light coming from a luminous point.

Recreation: To create anew, or to refresh from toil; what we do because we want to do it; re-creating the mind and body; wholesome and pleasurable behavior; action motivated by inner desire (no outer compulsion); spontaneity; not ordered, imposed, or forced; the individual has something to choose from and he is capable of making a choice; the motive is enjoyment and personal satisfaction, and the doing of it has its own appeal; the "when" is leisure, the "what" is recreation.

Recreation Areas: Land and water space set aside for recreational usage, such as parks, playgrounds, lakes and reservoirs.

Recreation, Commercial: Recreational services and activities, such as dance halls, bowling alleys, theaters, amusement parks, and carnivals organized primarily for profit and provided by business enterprises.

Recreational Facilities: Buildings and other physical features and provisions, such as swimming pools, community recreational centers, stadiums, and outdoor theaters, designed and constructed for recreational use.

Recreation, Municipal (Public): A program of public recreation provided by the corporate body for persons residing in any one of the several types of governmental units having the power of local self-government. It is financed primarily by taxation and includes the establishment, operation, conduct, control, and maintenance of programs, services, areas, and facilities.

Recreational Museum: An area or facility for preserving and exhibiting recreational objects and artifacts.

Recreation, Private: A recreational program and/or services established under the auspices of an agency or organization supported by other than governmental funds. Private agencies usually serve a particular constituency and often limit their services to a given area of a city and to those invited by the agency. Recreation is often a technique rather than the primary purpose in private agencies.

Recreation, State: A recreational program or service offered by a state agency, such as the state recreation commission, conservation department, or welfare department, on a statewide basis. The services may include operating a public area and facility such as a state park, carrying forth statewide research, planning and promoting new recreational programs, and/or advising local groups on various problems relating to recreation.

Redevelopment: An additional developing process.

Reflectance (Reflection Factor): The percent of light falling on a surface that is reflected by that surface.

Reflected Glare: Glare resulting from specular reflections of high brightness in polished or glossy surfaces in the field of view. It usually is associated with reflections from within a visual task or areas close to the region being viewed.

Reflection Factor: The percentage of light reflected by a given surface.

Refrigerants: Any of the various liquids that vaporize at a low temperature, used in mechanical refrigeration.

Resident Camping: A sustained group-living experience in the natural environment under trained leadership in which the surroundings contribute through program to the emotional, physical, and social growth of the individual.

Resiliency: Ability to bounce back or spring back into shape or position after being pressed or stretched; elastic.

Resistance: Any opposing friction causing force; the reciprocal of conductance.

Riser: The vertical distance (and pieces) between the steps in a stairway.

School Camping: An organized camping program conducted by a school as an integral part of the regular school program and emphasizing outdoor education.

Scuba Diving: Diving with self-contained underwater breathing apparatus (air tank).

Seeing: Visual perception; the act of discerning or obtaining information by means of the eyes and brain, and requiring light upon the object to be discerned.

Service Building: A structure affording the facilities necessary to accommodate the people using recreational facilities such as a golf course, swimming pool, or ice-skating rink. It may contain dressing rooms, lockers, toilets, shower rooms, check and storage rooms, a lobby or lounge, and a repair shop. Also, the term is used in reference to buildings that facilitate the operation and maintenance of the recreational system, such as greenhouses, storage buildings, and garages.

Shadow: The space from which light from a given source is excluded by an opaque object; the area of comparative darkness resulting from the interception of light by an opaque object.

Sheathing: The inner covering of boards or waterproof material on the roof or outside wall of a frame house.

Shelter House: A building, usually located on a playground or playfield, equipped with such features as an office for the director, space for storage, toilets, and a craft or play room.

Short-Term Residence Camp: A creative, cooperative experience in living in the out-of-doors in self-sufficient small groups for periods of five days or less.

Sight: The ability to see, which encompasses the object seen, the light reflected from it, the eyes that perceive it, and the sensory system that transmits this information to the brain.

Sill: A heavy horizontal timber or line of masonry supporting a wall; a horizontal piece forming the bottom frame of a door or window.

Sleeper: A piece of timber, stone, or steel, on or near the ground to support some superstructure.

Social Recreation: Activities or experiences primarily engaged in to produce sociability, such as parties, banquets, club meetings, picnics, and dances. Social recreation uses as a medium the activities of sports, games, drama, music, dance, nature recreation, and arts and crafts. The motivating purpose is to bring people together.

Soffit: The ceiling or underside of any architectural member.

Special Recreational Areas and Facilities: Areas and facilities designed, constructed, and equipped to meet the requirements of a specific form of recreational activity, such as a golf course, swimming pool, and athletic field.

Specifications: Detailed description of the parts of a whole; statement of enumeration of particulars, as to size, quality, and performance; terms; something specified.

Sports Recreation: Activities that usually require a great deal of physical movement and the use of specific equipment and areas. Examples are golf, tennis, hunting, fishing, skiing, and corecreational softball.

Athletics and sports are not synonymous; athletics is one of the many kinds of sporting activities frequently referred to as physical recreation.

Staggered: Arranged so that alternate intervals of space or time are used.

Stanchion: An upright bar, beam, or post used as a support; one of a pair of linked, upright bars.

Standards: Norms established by authority, research, custom, or general consent to be used as criteria and guides in establishing and evaluating programs, leadership, areas, facilities, and plans; as measures of quantity, quality, weight, extent, or value.

Stile: A vertical piece in a panel or frame, as a door or window; a set of steps used in climbing over a fence or wall.

Supervise: Oversee or manage a program, activity, or people, and arrange for economy of control and management.

Survey: A cooperative undertaking that applies scientific methods to the study and treatment of current recreational data, problems, and conditions. The limits of a survey are prescribed before execution and its facts, findings, conclusions, and recommendations are made common knowledge and provide a base for intelligent, coordinated action.

Synthetic: Artificial; not real or genuine; a substance produced by chemical synthesis.

Tanbark: Any bark containing tannin (used to tan hides) and, after the tannin has been extracted, it is used to cover tracks, circus rings, and dirt floors in field houses.

Template: A short piece placed in a wall under a beam to distribute the pressure; also a beam spanning a doorway, or the like, and supporting joists.

Terra Cotta: Clayware having the surface coated with fine slip or glaze; used in the facing of large buildings for relief ornament or statues.

Terrazzo: A type of flooring made of small chips of marble set irregularly in cement and polished.

Thermostat: An apparatus for regulating temperature, especially one that automatically controls a heating unit.

Threshold: A piece of wood, stone, metal, etc., placed beneath a door; doorsill; the entrance or beginning point of something; the point at which a stimulus is just strong enough to be perceived or produce a response, as the threshold of pain.

Topography: The configuration of a surface, including its relief; graphic delineation of physical features of any place or region.

Translucent: Transmitting light but scattering it so that details cannot be distinguished through the translucent medium.

Transparent: Allowing light to pass through so that objects behind can be seen distinctly.

Truss: To support or strengthen with a constructural truss; a bracket or modillion.

Underpinning: A supporting structure of the foundation, especially one placed beneath a wall.

Unglazed Tile: A hard, dense tile or homogeneous composition deriving color and texture from the materials of which it is made.

Utility: The degree to which an area, facility, or instrument is designed to serve its purpose, and the degree to which it is used; percent of usage during the workday adapted or available for general use or utility.

Validity: The degree to which an item or instrument actually does what it is intended to do.

Vestibule: A passage hall or chamber between the outer door and the interior of a building.

Vinyl Tile: Asphalt tile impregnated with vinyl.

Visual Task: Conventionally, those details and objects that must be seen for the performance of a given activity, including the immediate background of the details or objects.

Vitreous: Of, pertaining to, or derived from glass; like glass as in color, brittleness, and luster.

Wainscot: A wood lining or paneling on the lower part of the walls of a room.

Walkway: In this text, a predetermined, prepared surface; exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level and not deviating from the level of the existing ground immediately adjacent.

Wilderness: A rather large, generally inaccessible area left in its natural state available for recreational experiences. It is void of development except for those trails, sites, and similar conditions made by previous wilderness users. (No mechanical transportation permitted.)

Youth Center: A recreational building designed primarily to be used by adolescents. The center may be operated by a public or private agency or by a teen-age organization under adult guidance.

Zone Heating: Climate control placed in a building by area.

APPENDIX 2

ANNOTATED BIBLIOGRAPHY
FOR
AREAS AND FACILITIES
IN
PHYSICAL EDUCATION
AND RECREATION

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I. GENERAL

American Association for Health, Physical Education, and Recreation **Dressing Rooms and Related Service Facilities for Physical Education, Athletics, and Recreation.** Washington, D.C.: the Association 1972.

The publication identifies significant considerations in the planning of dressing rooms, locker rooms and related service facilities. Comprehensive treatment of each aspect has not been attempted. Used in conjunction with listed references and up-to-date information available from architects, this material should provide a sound foundation for planning these facilities.

Bucher, Charles A. **Administration of Health and Physical Education Program** 5th rev. ed. St. Louis: C. V. Mosby Co., 1971.

Chapter 16 of this book outlines the physical plant. It includes many photos, diagrams and sketches showing specific measurements, provides a formula for computing the number of teaching stations needed for physical education classes, and includes a checklist for facility planners. Its glossary can prove valuable to planners as an aid to understanding the dialogue of program specialists.

Coates, Edward. The role of the physical educator in facility planning. **The Physical Educator** 28:74, May 1971.

This article gives nine guiding principles for the construction of facilities and guidelines to follow in the initial stages of planning. Many common mistakes are listed that are often found after the buildings and areas are operational. Author urges the specialist or physical educator to become involved in the planning.

College and University Facilities Guide. Chicago: The Athletic Institute and American Association for Health, Physical Education, and Recreation, 1968.

This book is one of the finest on college and university facilities in health, physical education, recreation and athletics. Much like the 1965 **Guide,** which is designed primarily for school and community use, this edition is for personnel engaged or interested in facility planning.

Council of Educational Facility Planners. **Guide for Planning Educational Facilities.** Columbus, Ohio: the Council, 1969.

Although not specifically related to physical education facilities, this book is a handy reference for anyone interested in school or college planning of facilities.

What Went Wrong? Columbus, Ohio: the Council, 1968.

This unique book for those planning any educational facility tries to point out the many errors that can occur as a result of inadequate planning. One chapter is specifically related to health and physical education facilities.

Evans, Ben H.; Novak, Matthew A.; and Wagner, William G. **Shelter for Physical Education.** N.p.,n.d.

This is a report of a research project conducted by the Architectural Research Group of the Texas Engineering Experiment Station, in 1961.

Ezersky, Eugene M. **City to Country.** New York: Educational Facilities Laboratories, 1969.

This feasibility study explores the need for and availability of facilities for outdoor education in the New York metropolitan area. In addition, it gives details of a pilot project in outdoor education involving two classes of children from District #7 in the South Bronx. The report concludes that outdoor education is not only feasible for New York City but also highly desirable.

Facilities guide for physical education **Bulletin BA.** Florida State Department of Education, n.d.

This bulletin points to the various factors to consider when planning physical education facilities.

Jack, Harold K. Report of National Conference on Facilities for Health, Physical Education and Recreation **Journal of Health, Physical Education, Recreation** 36:6, May 1965.

The third National Conference on Facilities for Health, Physical Education and Recreation was held at Indiana University in January 1965. Participants realized many new developments in facility planning and construction and approached the task of revising the Guide which was produced at the first workshop in 1946. An attempt was made to identify new needs in a practical manner and to anticipate future needs.

National Association of College Directors of Athletics. **A Study In The Construction of Gymnasiums, Field Houses and Other Related Athletic Facilities.** Cincinnati: n.p., 1968.

This book contains the minutes of the second regional study and lecture series sponsored by NACDA. The book attempts to answer athletic directors' questions about construction of new facilities. Trends in today's facilities are also mentioned.

Physical Recreation. Columbus, Ohio: The Ohio State University, 1968.

This study was conducted to explore the idea of a new recreational facility for The Ohio State University. The faculty committee on university recreation worked on three tasks during 1966-1968:

1. Recreational opportunities at the university
2. Short-term improvement in recreational opportunity
3. A plan for long-range recreation development.

Also included is a digest of recommendations for physical recreation at The Ohio State University.

Physical Recreation Facilities New York: Educational Facilities Laboratories, n.d.

This report seeks to display the various current forms and shapes of facilities designed for physical education, interscholastic and intercollegiate sports, and recreation. It is not meant to advocate a general solution for everybody; rather it displays the more imaginative and economically prudent solutions that have been built or proposed for specific settings.

Planning Areas and Facilities for Health, Physical Education, and Recreation. Chicago: The Athletic Institute and American Association for Health, Physical Education, and Recreation, 1965.

This book is a must for all those interested in areas and facilities planning in health, physical education and recreation. The book covers basic concepts of planning outdoor areas and facilities, indoor facilities, aquatics areas and facilities, and health and safety areas and facilities.

Planning, Constructing and Utilizing Physical Education and Athletic Facilities. Columbus, Ohio: Ohio Department of Education, 1970.

The publication contains the major addresses from the Conference on Planning, Constructing, and Utilizing Physical Education, Recreation and Athletic Facilities. The publication contains some of the nation's most knowledgeable designers and planners of *facilities*. Some of the areas included are: trends and concepts, inexpensive structures, buildings of the future, construction of a gymnasium, common mistakes in planning, and multiple use.

II. INDOOR AND OUTDOOR FACILITIES

AIR STRUCTURES

Air-inflatable track facility for winter use at Harvard. **American School and University** 42:32, May 1970.

Harvard University has a new 45,000 sq. ft. vinyl-coated nylon track facility that cost less than 10¢ per cu. ft. Manufactured by Air-Tech Industries, it can be inflated in 15 minutes.

Anthony, Don. Blooming industry. **Times Educational Supplement** 2877: 39, July 10, 1970.

This British physical educator asserts that with the expansion of sports in developing countries the way is open to expand the production of facilities and miscellaneous sports education goods. Because of the lack of capital in many areas, the need is to provide new, creative approaches to product development, such as a foam cover (air bubble type) which is inexpensive and can be put up or moved. Coordination of such facility planning should take place through the International Committee For Sports Facilities and Equipment.

Bubble, bubble—Less cost, minimum trouble. **Nation's Schools** 85:76, Feb. 1970.

Advantages and disadvantages of air-inflatable buildings are discussed in relation to cost, maintenance, acoustics, lighting, heating and safety.

Ekstrom, Rurik. This may be your next bag. **American School and University** 43:30-32, June 1971.

The history of air-supported structures is discussed. The advantages of such structures are: (1) less energy is required to provide building space, (2) there is considerably less original cost outlay, and (3) the structures are less permanent, thus allowing for constant updating of architectural design. Air-supported structures also solve immediate building needs.

Engelbrecht, Robert. Bubble, bubble everywhere. **Popular Science** 202:92-95, March 1973.

The balloon-type bubble is a simple air-supported structure. The boat type is composed of inflated tubes or panels to make an air-inflated structure. A hybrid air structure, such as the Fuji Group Pavilion, has external walls or framework. All three bubble types may be used extensively for recreation and campus sites and to fight pollution.

Gardner, John C. Air-supported field house. **American School and University** 43:4, June 1971.

This is a realistic look at the problems Columbia University encountered in erecting an air-supported dome for the athletic department's winter track program. Problems met were: a required building permit, limited time in use (only from November to April), cost to heat, erection cost and maintenance, and heavy winds. But aside from these, "the air dome has proven to be a successful and satisfactory structure . . ."

His and hers. **American School and University** 43:42, June 1971.

Two air-supported sports structures (100 by 125 ft.) have served as boys' and girls' gymnasiums at Kingsborough Community College, Brooklyn, New York. Their cost was $68,000, which is 10 percent of the cost for permanent buildings the same size. Life expectancy is 10 years. The sports structures can withstand 80 m.p.h. winds, and are coated with a translucent vinyl to permit outside light. Inside lighting is also supplied.

Instant schools . . . Ready when you are. **American School and University** 43:42, June 1971.

This is another article about the Kingsborough Community College "his" and "hers" sports structures. Together with a smaller permanent building that houses locker facilities, they supply the needs of the physical education department within a restricted budget and will be used as a field house, gymnasium, track facility, and covering for swimming pools, tennis courts and hockey rinks.

Lightweight structures for education. **American School and University** 45:27-30, July 1973.

This article shows different types of structures that are already in use or are proposed for the future, including La Verne College's teflon-coated fiberglass tents and the double fabric membrane, air-supported covering that will enclose 11 acres of the University of Minnesota football stadium.

Martini, Joseph. Poly's roof-top gym. **Scholastic Coach** 40:7, Jan. 1971.

A small, private college in Brooklyn, hemmed in by skyscrapers, solved the problem of lack of physical education space by building an air-supported structure on top of the physics building. The article describes the construction and features of the bubble.

Pennsylvania's practice track bubble. **Scholastic Coach** 37:11, Jan. 1968.

This short article describes the country's first track and field bubble at the University of Pennsylvania.

Pierson, R. M. and Snyder, C. E. Enclosospace. **Parks and Recreation** 7:36, May 1972.

A new, inexpensive approach to enclosing large spaces has been developed and is being offered commercially. The authors discuss its principal attributes: low cost, unlimited area coverage, on-site assembly, portability, outline, maintenance, fire resistance and ability to handle the elements.

Puckett, John, Two promising innovations in physical education facilities. **Journal of Health, Physical Education, Recreation.** 43:40-41, Jan. 1972.

Shelters or limited shelters and air-supported structures are briefly described for consideration as physical education facilities. Examples and basic specifications for shelters are cited, especially for elementary school use. Air-supported structures are explained, including the types of anchorage systems, cost ($2.50-$4.00 per sq. ft.), and characteristics of the structures. The diagrams and pictures provide several helpful ideas.

These air structures excel at sports. **American School and University** 40:30, June 1968.

This article describes two air-inflatable structures used for athletics, one at the Forman School in Litchfield, Connecticut, and the other at the Hinckley School, Hinckley, Maine.

Trends in air-support structures. **Parks and Recreation** 7:34, May 1971.

This article describes latest trends in air structures for use over tennis courts, pools, pavilions, etc. Different designs are described with pictures to aid in planning and understanding the structures.

Try air structures for year-round activities with a minimal investment for your district. **Physical Education Supplement** 14:2, Jan. 15, 1970.

Bettendorf (Iowa) Middle School has an air-supported gym 148 ft. by 112 ft. Cost of the structure was only $4 per sq. ft. compared to about $24 per sq. ft. for a regular gym. The structure has added immeasurably to the school's physical education program.

AUXILIARY AREAS

Arbaugh, Jay. From closet to training room. **Scholastic Coach** 37:52, Jan. 1968.

The author tells how a dirty catch-all closet was converted into a fully equipped training room.

Browne, Robert. Innovations in sports facilities. **American School and University** 44:24, Nov. 1971.

The multipurpose concept involving as much space as possible is replacing the "gym concept." This article discusses different structures, synthetic surfaces and the University of Minnesota proposal to cover Memorial Stadium.

Brubaker, W. C. and Hutchinson, George. New life for old building. **College and University Business** 52: Jan. 1972.

Even though this article is not directly related to the facilities of health, physical education and recreation, it is interesting for physical educators. The author outlines a range of possibilities for giving old buildings a new life, such as renovation of an existing building for some other education function or for the same function, and remodeling of noneducational buildings for new college roles.

Dotter, Richard L. The multipurpose challenge. **Journal of Health, Physical Education, Recreation** 37:31, Sept. 1966.

The author presents both advantages and disadvantages of the multipurpose room which is used for both physical education and other activities, such as cafeterias and auditoriums.

Ezersky, Eugene M. Mini-gyms and fitness corners. **Journal of Health, Physical Education, Recreation** 43:38, Jan. 1972.

Creative use of space could turn a traditional school into a physical fitness experience. Stress the try-it attitude to change and develop new ideas and challenges.

Graves, Ben E. Kids swing with minigyms at Burnside Manor. **Nation's Schools** 92:35, Aug. 1973.

The Burnside Manor proves that an elementary school without space or money for a formal gymnasium does not have to go without. Eugene Ezersky, an Educational Facilities Laboratories consultant, says, "The problem of elementary schools is that they do not teach kids to be physically active and buildings contribute to this by being restrictive. This minigym concept may be the direction of future elementary physical education facilities." The minigym concept revolves around the principle of study carrels. Small areas of rooms are sectioned off and contain equipment which is accessible to all of the students at their own convenience, without undue confusion and traffic.

Holler, Robert L. Indiana state's reconverted physical fitness center. **Scholastic Coach** 41:10, Jan. 1972.

The article explains how the university arena basement was converted from a more or less dirty old basement to a clean useful area containing a 1/16 mile track, a weight training center, multipurpose cages, table tennis and an exercise physiology laboratory.

Luck, K. Cash and Neumann, Margaret. Physical education goes mod. **Journal of Health, Physical Education, Recreation** 41:44, March 1970.

The Regina High School physical education department has begun an exciting new program by expanding its curriculum to include four off-campus activities. The expansion was made possible by a switch from traditional scheduling. In addition to use of facilities, assistance in instruction is provided by the management at each area.

Making the most of multi-use space. **American School and University** 39:33, Sept. 1966.

Because many schools cannot afford separate facilities for physical education, eating, plays, etc., the multipurpose room seems to be the answer. With today's light, portable furniture, rooms may serve double or even triple duty.

Mitchell, Ed and Mahlstede, Jack. Circuit training for physical education. **Scholastic Coach** 42:18, Jan. 1973.

The authors discuss the weight program they have developed in Santa Fe Springs, California. Their circuit weight training system is on the balcony in the gymnasium. One hundred twenty students can work on the circuit at a time under the supervision of two teachers.

Mixing Media. **The Architectural Forum** 138:30, May 1973.

This article concerns the new multipurpose auditorium and arts center for Dickinson College. The arts building will accommodate studios and offices for art, dance and music and lounges for exhibition space.

Mutchner, John. Developing a training room. **Scholastic Coach** 35:32, Jan. 1966.

The author describes the steps involved in setting up a training room from scratch and the equipment needed for the job.

Pollock, Alexander. Multi-use stadium prototype. **Scholastic Coach** 41:22, Jan. 1972.

This type of multi-use stadium is designed for both school and community use. It provides several outdoor spectator areas for a wide range of sporting events as well as agricultural fairs, religious convocations and horse shows, plus the already existing indoor facilities such as pool, gymnasium, locker rooms, training rooms and classrooms. It is a design of the future with a total cost of about $5 million.

Rainey, T. Marshall. Hidden teaching stations. **Scholastic Coach** 42:7, Jan. 1973.

Various suggestions concerning the maximum use of physical education buildings and facilities are discussed in this article. The author relates many uses for the "cage" (field house), natatorium, arena, ice rink, locker room and laundry facilities.

Sheets, Norman L. Facilities for handball. **Journal of Health, Physical Education, Recreation** 39:76, May 1968.

Sheets points out that a handball program within the school need not be cancelled because of a lack of four-wall handball courts. Handball may also be played against one or three walls, and two walls may be constructed easily if one wall in the gym is available.

Steen, Barney. Side wall accessories. **Scholastic Coach** 41:42, Jan. 1972.

The article describes the portable side walls which Calvin College built to increase its facilities for handball and paddleball. The five portable walls provided four new courts in the balcony of the gymnasium.

Stevenson, Ian T. A jumping complex. **British Journal of Physical Education** 4:43, June 1973.

Here is a suggestion for a multipurpose jumping complex which has attempted, at low cost, to incorporate all the major athletic jumping events into one unit specifically designed for teaching.

Theibert, Richard P. Facilities for lifetime sports. **American School and University** 44:14-18, Nov. 1971.

This article explains the problems involved in designing facilities for athletics and expecting them to accommodate physical education and intramurals. The "open space" concept to accommodate a large variety of activities is discussed. Areas and facilities for lifetime sports are stressed.

COURT GAMES

Knight, Pamela. Fold it out and presto! Tenderloin is hamburger. **Sports Illustrated** 38:72-73, March 26, 1973.

Since squash is becoming more popular in the United States, facilities must be made available for participants. One suggestion for making existing gyms suitable for squash is to use a pre-assembled box-like structure made of stressed-skin plywood panels which fold open and close. It is estimated to cost $8,500 per unit.

Van Dis, John. Handball courts in future YMCAs. **Journal of Physical Education** 70:40-41, Jan.-Feb. 1973.

After explaining why YMCAs have not built handball courts for monetary reasons, the author suggests how to adapt handball courts to other activities. He also discusses the need for spectator space and how it should be developed. Diagrams illustrating handball court designs are included.

DOMED STADIUMS

Davis, William E. A stadium for all seasons. **College Management** 7:21-24, Feb. 1972.

Nicknamed the minidome, this new complex at Idaho State University was a winner from the time of completion. The building houses a stadium of 12,000 seats, dressing and locker rooms, offices, concession stands, rest rooms, a football field, a portable basketball court and board track, and a portable stage. This article describes steps taken in selling, planning and equipment selection for the new complex.

Geodesic dome shipped 3,000 miles to construction site. **School Management** 15:45, Sept. 1971.

This article tells how quickly and inexpensively a geodesic dome was shipped and erected. The dome houses ice hockey and can be converted to a number of activity areas for the school and community.

Geodesic domes span full educational range. **American School and University** 44:35, Nov. 1971.

This article gives the specifications of a field house with a geodesic dome which was recently built at Centenary College. Type of roofing and paneling, number of piers for the foundation, and interior square footage are given. Interior facilities in terms of teaching stations are also listed.

Notre Dame's twin-domed wonderland. **Scholastic Coach** 39:20, Jan. 1970.

Notre Dame's $8.6 million athletic convocation center is one of the two or three wonders of the college sports world. The twin-domed complex is 750 ft. wide and 630 ft. deep, and contains 460,000 sq. ft. of air-conditioned space. Virtually every sport — varsity, club and intramural — can play or practice somewhere in the superb complex.

Shuldiner, Herbert. Louisiana's new Superdome is world's largest sports cover-up. **Popular Science** 202:84-85, April 1973.

The Louisiana Superdome will enclose 125 million cu. ft. of space. The arena floor is 630 by 900 ft. The most interesting aspect of the dome is that the sections will move for various activities. It will be completed in 1974 and will house the New Orleans Saints, Tulane University teams and the Sugar Bowl.

The only domed high school field house in Washington. **Scholastic Coach** 42:16, Jan. 1973.

The article describes the field house at Washington High School, eight miles south of Tacoma, Washington. The structure has a triax dome with a light strip around the sides, a 90 by 94 ft. basketball area surfaced with Tartan over a concrete slab, a locker room for the basketball facilities, and a track. Other features, such as illumination and heating, are also discussed.

FIELD HOUSES

Advanced Encapsulated Fieldhouse. **American School and University** 44:31-32, Nov. 1971.

The article tells how Milligan College in Tennessee built the first $1.2 million multipurpose sports facility with an air-supported top that covers 60,000 square feet. The field house will be depressed into the existing terrain, thus maximizing the expenditure of budget to include more space for less money. The field house will be used primarily for lifetime sports, so a large building with lots of space was desired and built.

Dahne, Robert A. Synthetic covering for college field house. **American School and University** 42:16, May 1970.

Lynchburg College in Virginia recently built a new field house to increase its indoor space. Uni-Turf, a plastic vinyl, was used. This facility and synthetic surface provides a very versatile indoor area.

Fieldhouse promotes maximum usage. **American School and University** 39:33, Aug. 1967.

Missouri Military Academy's field house has three basketball courts and one court for tennis, volleyball and badminton. Since the floor is hard-surfaced, the building receives maximum use for reviews, parades, drills and ceremonies.

Multi-purpose mammoth. **College Management** 5:18-21, Aug. 1970.

Because of the climate, St. Lawrence University, New York, had limited outdoor athletic activity. The athletic department constructed a 160 by 260 ft. building which enclosed a one-tenth mile track, a tennis court and 20,000 sq. ft. of practice area inside the track.

New fieldhouse at Wentworth Military Academy. **American School and University** 39:90, May 1967.

Wentworth Military Academy's field house, which occupies 65,000 sq. ft., has a composition indoor running track, a basketball court and many auxiliary rooms. An Olympic-size swimming pool connects the old gym to the field house.

Product applications. **American School and University** 45:58, June 1973.

This short article describes the liberal open design of the Parkview Junior High School in New Castle, Ind., the new field house at the Thomas Jefferson High School in Arlington, Va., the use of aluminum seating at Hermitage High School in Richmond, Va., and the new indoor tennis courts at Yale University. Although this article is basically an advertisement, it allows the reader to look at some innovations in athletic and physical education facilities.

GYMNASIUMS

Award-winning gymnasium built for school and community use. **American School and University** 40:71, March 1968.

The architects of the Washington & Lee High School gymnasium in Montross, Va. recently won an award in design for the $342,000 facility, which is electrically heated and uses glass for natural lighting quite extensively.

Building. **American School and University** 43:36, Nov. 1970.

The University of California's new press box provides sportscasters with a crystal clear, wide angle view of the action in Memorial

Stadium. The front of the $500,000 structure is glazed entirely with clear and tinted plexiglass acrylic plastic. The acrylic plastic is retractable, thus leaving no posts or mullions. This style was adopted in place of the open wood press box to counteract heavy rain and high wind in the months of November and December.

Gymnasium in the round. **American School and University** 43:24, June 1971.

The dome-ceilinged circular gymnasium at Ann Arbor Huron High School is a three-level structure that can seat 4,000 people. On the dome a material named Tectum was used as a forming material while concrete was poured.

Here and there. **Athletic Journal** 53:4, Jan. 1973.

The new gymnasium at Union High School in Bellows Falls, Vermont, has a 15,600 sq. ft. facility without the usual folding partition separating the girls from the boys. On the few occasions when a partition is desirable, the bleachers, which are movable and have a solid back, are utilized.

McGowan, W. C. How to build six gyms — On budget. **American School Board Journal** 152:12, May 1966.

The author tells how Baldwin County in Alabama was able to build six gymnasiums at a total cost of $1.5 million. Because the six gyms were designed basically the same, costs were lowered considerably. A floor plan of the basic gym is included.

Meiser, William B. and Scott, Robert S. Portable climbing apparatus. **Journal of Health, Physical Education, Recreation** 44:61, March 1973.

This article is about a climbing apparatus which can be stored against a gym wall. It consists of climbing ropes, balance beams, chinning bars, window ladder and a cargo net, allowing for a variety of activities.

Millan, Anne F. An open gym. **Journal of Health, Physical Education, Recreation** 43:40, May 1972.

At Driscoll School in Brookline, Mass., the open classroom concept has spread into the elementary physical education program. The open gymnasium has become a facility housing three separate teaching stations, with a track of mats surrounding one of these areas. The three areas feature apparatus exploration, favorite games and perceptual-motor play.

Morrow, John and Morgridge, H. H. Tilt-up men's gymnasium suits sports and spectators. **American School and University** 39:27, Aug. 1967.

The new men's gymnasium at El Camino College, California, is of tilt-up construction, with panels combined with face brick and porcelain enamel fascia for the exterior. The gymnasium building has an area of 52,000 sq. ft.

Penman, Kenneth A. Let's build useful gyms. **American School and University** 42:14, Aug. 1970.

The author, an associate professor at Washington State University, makes a plea that architectural designs make physical education facilities both aesthetic and functional. He calls for planners to get away from building just for athletics and gives many suggestions for making physical education facilities more functional.

Pettine, Alvin M. Planning a gymnasium. **Journal of Health, Physical Education, Recreation** 44:58-62, Oct. 1973.

This article deals with the specifics of building a gymnasium. It stresses the importance of the physical educator working closely with the architect in planning the roof, floor, walls, lighting and acoustics of a new gymnasium.

Puckett, John. Gymnasium specifications for elementary schools. **Journal of Physical Education** 70:251, Sept.-Oct. 1972.

This general overview by an Auburn University professor concerns the planning of indoor activity areas in elementary schools. He notes that consideration of community recreation facilities must accompany the primary concern for health and physical education facilities.

Rupnow, A. A. Ladders in elementary physical education. **Journal of Health, Physical Education, Recreation** 42:57, May 1971.

Using a model of the ladders developed in 1965 in Yugoslavia, the author presents a new concept for the gymnasium. Words and pictures describe how teachers can use ladders in their programs, some of the benefits, and how ladder movements carry over into other common movements.

Shaver, J. A. Designing for physical education. **School Activities** 45:42-43, Sept. 1971.

Inspired by student graffiti on the old gym, Pacific University's new 90,000 sq. ft. athletic center at Forest Grove, Ore., incorporated superword labels to identify areas and entrances, rainbow-colored bands to cover pipes and electrical systems, and a giant (60 ft.) mural collage depicting scenes from basketball, baseball, football and track to span the lobby from the gymnasium to the enclosed field house. The athletic center is a warm, alive space with the personality of an architectural happening.

The astronauts' insulated steel gym. **Scholastic Coach** 35:7, Jan. 1966.

The astronauts' gymnasium in Houston is 70 ft. by 122 ft. and is equipped with squash and handball courts, apparatus and areas for other court and net games.

The space age gym. **Scholastic Coach** 37:10, Jan. 1968.

The author describes the new physical education complex at Champaign Centennial High School in Illinois. A fascinating and unique aspect of the new building is the locker room facilities. The lockers are placed on a pedestal which also serves as a bench for the students. Inside the pedestal a ventilating system was installed to pull air from the locker vents to the outside, thus eliminating the traditional locker room odor.

Toman, Thomas G. New equipment features horizontal ropes. **Journal of Health, Physical Education, Recreation** 44:61, March 1973.

The author has invented a new piece of equipment which uses horizontal ropes that can be attached at various heights and levels. It also incorporates other apparatus such as ladders, swings and rings. It has five student activity stations so it can be used by many students at a time. This type of apparatus emphasizes development of arm and shoulder strength.

INDOOR TENNIS

Alschuler, Alfred S. Building quality tennis courts. **Parks and Recreation** 5:27, Oct. 1970.

The author stresses factors that are important for park and recreation personnel to consider before building tennis courts, such as types of surfaces, location, design and equipment. Several sources for additional information are listed.

Austin, D. A. Gymnasium adaptation for indoor tennis. **Athletic Journal** 52:16, Feb. 1972.

The author illustrates a very sound and safe method of adapting a gym facility for use as a tennis facility. The specialization in sport today and the limited weather in the North make such an adaptation necessary.

Building the world's largest tennis stadium at University of Wisconsin. **American School and University** 41:51, May 1969.

The indoor tennis and squash courts at the University of Wisconsin were completed in May 1968 at a cost of $2,406,500. These courts (12 tennis and 6 squash) serve over 6,000 players each week. An article on this stadium appeared in the May 1970 issue of the **Journal of Health, Physical Education, Recreation.**

Christionseau, Charles M. On indoor tennis courts. **Parks and Recreation** 3:43-50, Feb. 1962.

A group of concerned citizens in Omaha, Nebraska, expressed need for indoor tennis courts because of the popularity of the 15 outdoor courts in use during the playable months. After making many surveys and compiling data, and with help from the Chamber of Commerce, the project was completed. Fund raising and a loan from a working park developed the four courts.

Johnson, Walther A. The Nielson Tennis Stadium. **Journal of Health, Physical Education, Recreation** 41:36, May 1970.

The University of Wisconsin has an indoor facility which contains twelve tennis courts, five singles squash courts and one doubles squash court, completely enclosed. With air cooling, diffused lighting and resilient surfaces, these courts provide for year-round day and night participation.

Keller, R. J. Planning collegiate tennis facilities. **Athletic Journal** 50:32, March 1970.

Keller stresses the importance of careful planning before constructing new tennis facilities or resurfacing existing ones.

Kraft, John A. Courts on your campus. **Scholastic Coach** 34:22, Jan. 1965.

The author outlines the pros and cons of two types of tennis courts, the fast-drying and the all-weather. Also included is a detailed discussion of procedures for ordering, planning, building and maintaining fast-drying tennis courts. The all-weather court eliminates the need for daily maintenance although the cost is greater than that of the fast-drying court.

Soden, John W. Planning an indoor club. **Tennis Industry** 1:10, May 1973.

This article discusses comprehensive guidelines for building and operating an indoor tennis club. It covers sites, court building, surfaces, lighting systems, heating, cooling, hobbies, reception areas, pro shop and other areas.

Tym, Alice. Indoor tennis clubs in the U.S. **World Tennis** 16:32-38, March 10, 1969.

This article discusses various tennis clubs throughout the United States. Many building materials are mentioned, including several of the newest surface materials. Initial costs are listed, along with the facilities included. Several pictures illustrate many different styles in structures.

LAUNDRY EQUIPMENT

Selway, C. Philips. Equipment and laundry rooms. **Scholastic Coach** 34:30, Jan. 1965.

The author outlines the procedures of organizing and managing equipment and laundry room facilities at the University of Delaware. The school is blessed with ideal facilities and budget, as evidenced by its supplying all students and faculty members with a complete change of clothing before working out. The author offers many helpful hints on selecting, buying, repairing and taking inventory of equipment.

Sprague, Vernon S. Cost factors for institutional laundry services. **Journal of Health, Physical Education, Recreation** 42:41-42, Feb. 1971.

Based on the state universities and colleges in the Oregon State System of Higher Education, this article compares the costs of an institutional laundry to those of a commercial firm. It appears that a physical education department can launder clothing at approximately one-third the cost of a commercial laundry. Advantages other than economic ones are also discussed.

LOCKER, SHOWER AND DRESSING AREAS

Dickey, Donald. Choosing the right athletic locker for schools and colleges. **American School and University** 39:35, Aug. 1967.

The author tells us what to look for before ordering athletic lockers for the school. Locker construction, color, latching devices and number plates must be taken into consideration.

Woods, John B. Dressing up the dressing room. **Athletic Journal** 48:64, Feb. 1968.

Woods describes how the addition of commercial carpeting in the locker room will aid in appearance, maintenance and hygiene.

NATATORIUMS

A pool for all seasons. **Scholastic Coach.** 37:21, Jan. 1968.

The new swimming pool at Mamaroneck, N.Y., is an indoor-outdoor pool located in the first permanent structure to use a dual-coated fabric roof that is inflatable and deflatable. The roof combines the features of a conventional structure with the advantage of being removable.

Buchter, Robert Alan. Unusual three-pool complex designed for deaf children. **Swimming Pool Weekly 1970 Date and Reference Annual** 43:40-43, Sept. 1969.

A pool complex for a physical education facility at the Mill Neck Lutheran School for the Deaf was designed to handle the problems of children with no hearing ability. Flashing rows of signal lights and pools on three different levels are among the devices used. The design of the building also allows for easy access from a massive mansion which has been converted into the actual school setting. A listing of the construction details follows the article.

East Hartford's two swimming pool additions can be opened to the outdoors. **School Management** 16:32, June 1972.

This article explains the East Hartford (Conn.) Board of Education's completed construction of versatile swimming pools for its two high schools. During the school day, the pools are the responsibility of the Board of Education and are used by students in physical education and competitive events while after school hours and on holidays the Parks and Recreation Department manages them for the public. Indoor-outdoor atmosphere is achieved through the use of aluminum walls with sliding glass doors leading to open patios, and two 45 by 75 ft. skylights can be opened independently of each other and stopped at intervals for optimal sun and breeze control.

Edwards, P. R. English pool for blind proves value. **Swimming Pool Weekly 1970 Data and Reference Annual** 43:31-32, Sept. 1969.

Even though the Royal Normal School for the Blind at Rowton Castle, England, cost $84,000, the school justifies the expense with a most successful teaching program. The article explains the various designs which are advantages in a pool for the handicapped, such as sound directional aid, floor tiles of varying braille-like textures, handrails, sloped runs and floating guidelines.

From East and West: Two indoor swimming pools. **American School and University** 39:29, Aug. 1967.

The article describes Pacific Lutheran University's shaped pool with glass walls on three sides, and Central Connecticut State College's natatorium, in which seven locker room and shower room areas lead to the swimming pool deck.

Hubbard, Lloyd. Pool maintenance costs plunge with automatic controls. **American School and University** 44:20-22, Dec. 1971.

The author, president-elect of the National Swimming Pool Institute, illustrates through case histories that automatic controls generate savings in operating time and maintenance costs by holding chlorine and pH at precise levels. Low-cost automatic water quality control is rapidly spreading in the pool field for reasons of public health, comfort, economy and system protection.

Mason, James G. and Sheriff, Bert. Conversion: An outdoor swimming pool becomes an indoor pool. **Journal of Health, Physical Education, Recreation** 43:26-27, Nov.-Dec. 1972.

The authors explain their solution for converting their outdoor swimming facility to a year-round one. Construction considerations, building facts and features, and program advantages are described for other institutions with a similar problem. The rigid frame steel building cover provides a reasonably inexpensive interim solution (approximately $50,000 including lighting and heating) until a permanent facility is built.

Robertson, D. H. Pools in schools. **National Education Association Journal** 56:41, May 1967.

The author says that the school swimming pool is one of the most frequently used facilities and outlines the components of an excellent swimming program.

Sigismund, Rita. Swimming pools galore. **Parks and Recreation** 5:35, May 1970.

Cooperation efforts of county, city and school district agencies will result in six new indoor pools for King County, Wash., this year and an additional eight within the next seven years. Construction was financed through a $118 million park bond issue passed by county voters and the pools will be built on land provided cost-free by local school districts.

Smith, Robert J. Designing tomorrow's aquatic center. **American School and University** 40:23, Aug. 1968.

The author, an architect, tells how the new swimming and diving facility at Princeton University was designed as an "aquatic center of the future." The area includes a separate diving practice pool and a large pool, 165 by 60 ft., which is divided in half by a submergible deck 60 by 15 ft.

Springfield College Natatorium. **Journal of Health, Physical Education, Recreation** 39:92, Jan. 1968.

The Art Linkletter Natatorium is judged as one of the largest and best-equipped college aquatics facilities in the East. The article describes the size and uses of the $850,000 building.

Swimming pools '71: Symposium. **Parks and Recreation** 6:29, March 1971.

This article contains ideas for those interested in the new federal funds available for construction of swimming pools in urban areas since February 1971.

Van Dis, John. Movable floor swimming pools for YMCA's. **Journal of Physical Education** 67:16, Sept.-Oct. 1969.

The author discusses how safety requirements are making a YMCA one-pool facility inadequate for the variety of activities and age groups using it and how cost is limiting the construction of more pools in the same area. He advocates building pools with movable bottoms as a solution, explaining the idea well and making it sound interesting.

PHYSICAL EDUCATION COMPLEX

A junior high that's more than a school. **American School and University** 45:30, March 1973.

This article is about the innovations of building construction at Thomas Jefferson Junior High School and Community Center in Arlington, Va. The school is actually three in one. The facility aims at the total development of the intellectual and physical needs of a community. The Controlled Environmental Facility, containing 68,000 sq. ft. of enclosed space, is a year-round, air-conditioned facility with a 30 ft. ceiling. It allows for tennis, basketball, track, softball, football and other physical activities on its synthetic floor.

An architectural happening at Pacific University. **Scholastic Coach** 42:12, Jan. 1973.

Pacific University's Athletic Center is a structure which, with its distinctive graphics and exciting color combinations, clearly represents the students. The facility contains three major areas plus an underground locker room complex. The main gym area houses three basketball courts while an enclosed grassy area is available for outdoor sports. Between these two equal sized areas is a smaller area for court games such as handball.

Auditoriums, arenas, coliseums, theaters. **AudArena Stadium** 2:77, Fall 1968.

Here is one of the most complete listings published in 1968 on auditoriums, arenas, coliseums and theaters in the United States. The list includes pertinent information on each facility, such as the directors, phone number and size of the facility, seating capacity and uses.

Bailey, Sherm and Rowley, Lloyd. A school for today and tomorrow. **Journal of Health, Physical Education, Recreation** 40:31, Sept. 1969.

Careful planning went into the construction of the Mt. Stuart Elementary School in Ellensburg, Wash. The development of this facility focused on three major units: basic instructional rooms, activity areas and an instructional materials center. The article describes the facility in detail.

Bischoff, David C. Designed for participation. **Journal of Health, Physical Education, Recreation** 37:29, March 1966.

The University of Massachusetts has developed an unusual gymnasium facility which allows the students to enjoy a wide variety of instructional and recreational activities. It is a beautiful four-floor structure, and the article covers each level.

Browne, Robert Lee. Innovations in sports facilities. **American School and University** 44:24-30, Nov. 1971.

This is an excellent look by an architect at the antiquated gymnasium. He outlines innovative trends and proposals for multipurpose areas and structures. "Special purpose" is out as far as athletic buildings are concerned, and flexibility to accommodate the increasing variety of demands thrust upon the facility is in. Valuable layout drawings with flexibility in mind are shown. Imagination and innovation are stressed, with the ultimate purpose of building facilities which will be flexible and functional over long periods.

Conklin, Richard W. Notre Dame's twin domes serve university and community. **AudArena** 3:10, Feb. 1969.

The twin-domed facility at the University of Notre Dame combines a campus indoor athletic facility and a civic center. Cost of the two domes was $8.6 million. The Athletic-Convocation Center has more ground under its roof than the Houston Astrodome.

Crawford, Wayne. The latest in indoor physical education facilities. **American School and University** 39:81, May 1967.

The author illustrates how the University of California at Irvine planned its physical education, intramural and athletic facilities for the future, extending from 1965 to 1990.

Eddy, J. Robert. Brookline's new physical education building. **Scholastic Coach** 39:18, Jan. 1970.

Brookline, Mass., solved a space and land cost problem by designing a four-story physical education complex. The first level houses a handball court, squash court, dance gymnasium, wrestling room, weight room, lockers and showers. The next two levels have two full-size gyms while the top floor is a simulated outdoor area with uniturf flooring.

Ezersky, Eugene and Theibert, P. Richard. City schools without gyms. **Journal of Health, Physical Education, Recreation** 41:26, April 1970.

The authors suggest that inner-city school planners should replace the "box type" gymnasium with school-community physical education facilities where pupils could better develop their sport skills.

Giant beams to be used for physical education complex. **American School and University** 42:25, Aug. 1970.

Four giant beams will be used to support the roof of a new physical education complex at Juanita High School, Kirkland, Wash. The beams are 125 ft. 4½ in. long, 98 ft. deep and 14½ ft. thick, the largest ever manufactured by Timber Structures, Inc. These huge beams will supply an abundance of post-free space, which is ideal for physical education.

Go West, young gym designer. **Scholastic Coach** 42:11, Jan. 1973.

The new West High School in Wauwatosa, Wisconsin, has a splendid physical education complex consisting of three gymnasiums which may be divided into halves, a swimming pool, a diving pool, locker rooms and staff offices. Because of such a well-planned facility, students may participate in many varied activities in this no-study-hall, modular system school.

Gray, Charles A. Comprehensive and complete physical education center. **Athletic Journal** 49:34, Jan. 1969.

Alma College in Alma, Mich., has a new school-community physical education facility which makes extensive use of "Tartan" surfacing. The facility includes an all-purpose gymnasium, swimming pool, dance studio and a general activities area used for wrestling and weight lifting.

Hull, Wesley F. A physical complex — California style. **American School and University.** 40:82, May 1968.

The new physical education facility for the College of Marin at Kentfield, Calif., serves the community as well as the school. It was designed in relation to the adjacent residential surroundings and to the outdoor environment.

Keep these plan errors out of your physical education center. **American School and University** 40:39, Aug. 1968.

This is the ninth installment of *What Went Wrong*, a planning book by the Council of Educational Facility Planners, Columbus, Ohio. This article suggests ways to keep planning errors out of physical education facilities before they are designed.

Keller, R. J. Making the most of your old facilities. **Journal of Health, Physical Education, Recreation** 42:28, June 1971.

The author attacks two problems — restoration of facilities and scheduling facilities. He cites examples of restoration in ceilings, pools and floors as money saving and sensible. A sound and simple formula for scheduling maximum use of the facilities is discussed.

Kittilsby, Jim. Pacific Lutheran's auditorium gymnasium-fieldhouse. **Scholastic Coach** 41:14-17, Jan. 1972.

The article describes the new auditorium-gymnasium-field house complex built on the Pacific Lutheran University Campus. The facility includes a 100 by 138 ft. gymnasium (including a stage) with a Uni-Turf floor and a field house 97 by 115 ft. with an Astro-Turf surface. The facility was built to house athletic, intramural, recreational, concert, commencement and other public event crowds.

Let's look at new sports areas. **American School and University** 40:17, Aug. 1968.

The article takes the reader on a tour of new facilities, including the new L. Stockwell Jadwin Gymnasium at Princeton, the Art Linkletter Natatorium at Springfield College, the Haideville, South Carolina, High School gymnasium, the U.S. Coast Guard Academy's field house, the Upper St. Clair (Pa.) Activity Center, and a multipurpose gymnasium at Normandy High School in Missouri.

Mathews, David O. The University of Illinois plans an intramural — physical education building. **Journal of Health, Physical Education, Recreation** 39:33, April 1968.

The author explains what went into the planning of the University of Illinois' Intramural-Physical Education Building, started in January 1968, and what will be included in the building when complete.

McCabe, Bill and Wiseman, Robert. Eastern's star: A facility with a future. **Athletic Journal** 48: May 1968.

The physical education facility at Eastern Illinois University, finished in the fall of 1966, is complete with pool, gymnasium, field house, fitness area, rifle range, gymnastics and wrestling room, and handball courts.

McCoy, William. School-community rec center. **Scholastic Coach** 39:14, Jan. 1970.

Westchester County, N.Y., has a new facility to complement a recently completed middle school, which is also designed to be used by the community. Facilities include a 10,000 sq. ft. gymnasium and a 110 by 75 ft. indoor-outdoor swimming pool which has a fabric convertible roof.

Modernistic high school sports complex. **Scholastic Coach** 41:12, Jan. 1972.

The article describes the new sports complex built in Ralston, Neb. for $18.40/sq. ft. It explains the reasons behind the horseshoe-shaped complex, which includes three basketball court floors, 3,000 folding seats, a 75-ft. pool, another station 35 by 108 ft., four locker areas, a laundry room, a seating capacity of 500 in the pool area, a coaches' conference room, storage rooms and training rooms.

Moriarty, R. J. PERT planning for physical education facilities. **Canadian Association of Health, Physical Education and Recreation Journal** 39:33-36, Aug. 1973.

The author describes physical educators' preparation for and contributions to facility planning. He feels PERT (Program Evaluation Review Technique) is an effective method for initiating the structure necessary to complete a complex program demanding cooperative effort such as is needed in facilities planning.

Murray, John T. Lower Merion's physical education complex. **Scholastic Coach** 35:8, Jan. 1966.

Lower Merion, Pa., built a physical education plant to go along with its new school. The complex includes two gyms and a natatorium which is described by aquatic director Ed Conrad as one of the finest in the country.

New Carlisle High School. **Ohio School Boards Journal** 17:16, June 1973.

The gym floor of this new school is recessed so that the roof line of the building is continuous. Additional spectator space was provided by use of an open corridor which surrounds the gym floor. The bleachers are entered from the upper main level through gates in the railing which align with the bleacher aisles. The gym has a vinyl floor and the acoustics are good.

New facilities. **AudArena Stadium** 2:30, Fall 1968.

Not an article as such, this reference simply lists and tells a little about the many new facilities that opened from September 1967 to December 1968, those that were scheduled to open in 1969, those that were under way in 1969, and those that had major renovations or additions.

Nierman, Wayne H. The community school and recreation. **Journal of Health, Physical Education, Recreation** 43:53-55, March 1972.

The article illustrates an example of a community school which fulfills both learning and leisure activities for the public in Flint, Mich. The facility's effectiveness was enhanced by using designs suitable for indoor/outdoor purposes. A roof which deploys from one area to another and a skating rink which converts to tennis courts were included for flexibility.

1969, a year of new sports arenas. **American School and University** 41:21, Aug. 1969.

This article describes various sports arenas with innovations, including Clemson University's coliseum, Gettysburg College's Musselman Stadium, Montclair State College's pool, Ball State University's stadium, Shady Side Academy's athletic complex, Swarthmore's field house, Old Dominion College's new health and physical education facility, Hofstra University's physical fitness research center and Phillips Exeter Academy's new physical education facility.

Once in a lifetime sport facility. **Scholastic Coach** 42:48, Jan. 1973.

A hyperbolic paraboloid is the design of Boston College's unique multipurpose recreational sports complex. The complex consists of three major units: the field house (325 by 130 ft.), the swimming pool (130 by 97 ft.) and the various sport areas and locker rooms (130 by 97 ft.). Many more details are available about this unique facility which was built basically by student fees added for this specific purpose.

Padjen, John and Castner, Lillian. New Trier High School West. **Scholastic Coach** 37: Jan. 1968.

The beautiful new physical education complex at New Trier High School West is explained in detail. Facilities include the boys' physical education, girls' physical education and natatorium units.

Physical education plant complete. **Scholastic Coach** 35:12, Jan. 1966.

Connecticut State College has a physical education plant 300 by 220 ft. Facilities include a 4,500 sq. ft. gymnasium, a natatorium wing and two classroom-office wings. The article describes the complex in detail.

Revolution in sports: The anatomy of the body shop. **Nation's Schools** 92:51-54, Sept. 1973.

The body shop refers to a radical approach to physical education facilities. This two-level, free-standing building was built with the concept of elective activities. Students select their own sports, "then receive diagnosis, prescription, and evaluation from instructors." This facility includes a gymnasium with maximum flexible space and a multimedia center solely for the use of the physical education department.

Stadiums, ball parks, grandstands, tracks. **AudArena Stadium** 2:197, Fall 1968.

This is a sequel to the listing on "Auditoriums, Arenas, Coliseums, Theaters" in **AudArena Stadium,** Fall 1968.

Technology upsets elements in these athletic facilities. **American School and University** 41:27, Aug. 1969.

It appears that science has surpassed the environment, as evidenced by such innovations as artificial turf, and has done much to improve the quality of sports. New facility ideas are presented in the article.

Two-story gym solves traffic problem — Wisconsin State University, Eau Claire. **American School and University** 43:23, June 1971.

Two stories are shown to be very effective in regulating traffic of students separately from that of the general public. It contains gymnastics, wrestling and storage areas.

III. OUTDOOR AREAS AND FACILITIES

ATHLETIC FIELDS

Baseball to football — And vice versa. **AudArena** 3:24, April 1969.

A new development by 3-M Company, makers of Tartan turf, allows the Pittsburgh and Portland, Ore., stadium authorities to convert a complete baseball diamond into a football field in just four hours. This is done, using artificial grass, via a product called 3M Brand Hedlock fasteners.

Delamater, James B. A look at today's outdoor physical education facilities. **American School and University** 39:82, May 1967.

Delamater takes a look at many outdoor areas for physical education and athletics, including challenge courses, aquatics activities, gymnasiums, tennis courts and all-weather tracks.

Kahler, Robert W. Pamper that football field. **Athletic Journal** 50:72, Jan. 1970.

Since many schools cannot afford artificial turf on their football fields, the author suggests ways of improving the appearance of existing fields, such as mowing, using fertilizer, watering and striping.

Planning outdoor areas for athletics and recreation. **American School and University** 39:23, Aug. 1967.

This article is a guide to the proper selection of facilities and areas. Choice of activities should be based on feasibility, season, progression and variety.

Robey, Melvin J. and Daniel, William H. Maintenance of athletic fields. **Athletic Journal** 51:68-70, April 1971.

The authors, a superintendent of athletic facilities at Purdue University and a doctor of agronomy, tell how to maintain the turf of athletic fields. They advocate the use of known agronomic principles concerning selection of adapted grasses, fertilization and watering along with manicuring procedures of aerification, top-dressing, pesticide application, over-seeding, drainage improvement, plugging and rolling.

CAMPING

Biering, Mary Francis. New multipurpose camp offers ideas you can use. **Camping Magazine** 42:8, Sept.-Oct. 1970.

This article describes the cooperation, consultation and long-range planning that has made Rancho del Chaparral a year-round, multipurpose camp. Details of cost, layout, equipment and program give a picture of this camping situation.

Careful design results in attractive, functional camp office. **Camping Magazine** 42:10, Sept.-Oct. 1970.

The administration building at Camp Greylock (Mass.) was designed by an architect who was formerly a counselor. The building has three basic areas at different levels in a hillside: (1) an easily accessible area for campers, counselors and general public, with phones, (2) an area for small conferences among the administration, head counselors and division heads and (3) an inner private work area with permanent records.

OUTDOOR TENNIS

Whalen, Joe. Construction today. **Tennis Industry** 1:6, March 1973.

This article makes helpful suggestions in planning a multicourt tennis facility. The things to be considered include number of courts planned, type of membership, projected percentage of young players, surfaces, clientele and type of terrain.

Construction today. **Tennis Industry** 1:5, May 1973.

There are many items to be considered when choosing the type of surface for a tennis facility. These include the players' choice, budget, maintenance available, court supervision, climate and whether indoors or outdoors.

Construction today. **Tennis Industry** 1:15, June 1973.

This article discusses the tremendous demand on the tennis court industry for new courts. The biggest problem is experienced manpower to meet the ever-increasing demand for courts.

What's the big idea! **Scholastic Coach** 42:14, Jan. 1973.

This article describes recent innovations in athletic facilities and equipment such as court covers for tennis and pool mirrors.

SCHOOL PLAYGROUNDS

Aaron, David and Winawer, Bonnie. **Child's Play.** New York: Harper & Row, 1965.

This book gives a very realistic approach to the problems of playgrounds. It shows what is wrong with yesterday's playgrounds, new places to play in a no-space age, play spaces in suburbia and play spaces for the child with a problem.

Athletic and play areas. **American School Board Journal** 150:32-55, Feb. 1965.

This collection of articles and advertisements includes: "Playground Aestheticism Part of American Heritage," "Designer Considers Community Needs," "Here's Exemplary Athletic Setup," "Hard Turf Problems Softened," "Pavements—Past, Present and Future," "What is Legally Adequate Playground Supervision?" "Determined Music Teacher 'Composes' Physical Education Symphony," "Fundamentals in Selecting Gym Seating," "Daylight Saving Some Costly Light Problems," and "New Products in the Field."

Cook, William. Picking playground equipment. **American School and University** 44:38, Aug. 1972.

This helpful guideline informs readers what to look for and think about before investing in playground equipment in regards to safety, durability, construction and service.

Cutler, Marilyn H. Pacesetting playgrounds: City schools grab the lead. **American School Board Journal** 158:11, Aug. 1970.

The author examines the development and use of two inner-city playground-schoolyard recreation areas. Advocating innovative use of color, design and materials, she emphasizes that much can be incorporated in a postage stamp-size inner-city area with proper design. Although the article describes two real situations, it is doubtful if these ideas could be implemented in most usual situations because of cost. Both playgrounds were funded by the Astor Foundation.

Dattner, Richard. Playgrounds aren't for playing; Playgrounds are for growing and learning. **American School Board Journal** 160:30-31, April 1973.

The author is an architect who believes a school playground is as important as a school building and should be accorded comparable consideration during its design and construction.

Ellis, M.J. Today's playground: Designed for chimp or child? **American School and University** 43:21, Aug. 1971.

Playgrounds should be designed to meet children's needs, not to display the designer's creativity. This article, excellent for PTA groups, lists several central ideas that should be taken into consideration before the selection of equipment.

Fredrickson, John H. Before you call an architect. **American School and University** 44:72, May 1972.

The author, a school facilities consultant, outlines what the initial plans for design of a school should include.

Gordon, Ronnie. Playgrounds can be experience equalizers. **American School and University** 45:37, June 1973.

The Jessie Stanton Developmental Playground for Pre-School Handicapped Children has an experience philosophy behind it. A map and a picture of the playground are presented. The details for the bridged treehouse, the foam and sand pits, and the water and tables are given in depth.

Hanson, Robert F. Playgrounds designed for adventure. **Journal of Health, Physical Education, Recreation** 40:34, May 1969.

Innovations in playground design are discussed including use of hills, farm animals, wood, traffic playgrounds, color and landscaping, and vehicles.

Hause, Ronald. Up there and down here: Two special playgrounds. **Nation's Schools** 82:25, Aug. 1968.

The article describes two unique playgrounds, one on an elementary school rooftop in Greenwich Village, and the other in Teaticket, Mass., a school playground with a combination of slides, cable cars, climbing platforms and balancing rails.

How schools can find the proper playground surface. **Nation's Schools** 79:78, Jan. 1967.

The article discusses the pros and cons of a variety of playground surfaces, such as asphalt, natural soil, sawdust, turf, composition, rubber matting and synthetic turf.

Kula, Robert H. A play-area design that's something spatial. **Scholastic Coach** 40:14, Jan. 1971.

Multipurpose facilities are provided by using the "place space" technique in design, which provides for spaces without walls so that a multitude of activities can be performed. Excellent photos provide insight into the future of design in relation to space, surfaces, conformation to rule satisfaction and environmental control.

McGuire, R. F. Adventure playgrounds: New type playground in Milpitas, California. **Education Digest** 37:32, March 1972.

Adventure is the purpose of this new type of play and recreation area for children, characterized by piles of scrap wood and other building materials lying around. Reasons are given for most recreation departments' dislike of untidiness and fear of injury. The author refers to the trend toward this type of playground in America.

Pennington, Gary. Slide down the cellar door: New approach to playgrounds. **Instructor** 81:74, March 1972.

The author describes the advantages of the new adventure playground approach. Major points mentioned include justification, safety, costs and leadership. Sliding down cellar doors is compared to new trends and ideas in playground thought.

Playgrounds from junkyards. **American School and University** 44:22-23, Aug. 1972.

This short article describes innovative possibilities for playground equipment.

Seker, Joann. A scavenger playground. **Journal of Health, Physical Education, Recreation** 42:53, May 1971.

The author points out that a challenging, intriguing, exciting playground is a must, and well within the budget of any school today. According to the author, a playground can be built for less than $100 initially and costs a fraction of that to maintain and improve each year.

Wallach, Francis. Mobile playgrounds save money. **American School and University** 45:46, April 1973.

Mobile playgrounds are a way to save money yet still provide new and varied activities in physical education programs. The idea started in summer recreation programs with swimming pools and roller skating units, but now has become part of the regular school physical education program.

SKATING RINKS

Basic steps in planning and building an ice rink. **A Trade and Sport Publication.** U.S. Hockey B 12, Vol. 1, Oct. 1978.

This guide is four articles from the magazines **Rink** and **Arena.** They give excellent coverage of many topics that are easily forgotten or overlooked.

Part I—Advance work (selection of the location and type of rink)
Part II—Rink construction and operation
Part III—Bids and how to handle them
Part IV—Management

Throughout the articles the importance of using experts and experienced people for guidance and construction is stressed.

Outdoor skating rink at Gordon College. **American School and University** 39:84, May 1967.

Gordon College in Wenham, Mass., secured a used ice rink in Virginia, constructed a building to house it and purchased a "Zamboni." Construction cost was $200,000.

The systems approach to skating rinks. L.T.P. Enterprises, 1973.

L.T.P. Enterprises has a system for building ice rinks which seems to be very economical and efficient. They have four systems:

1. Structure—tension structure of long-life, vinyl-coated fabric held in tension by laminated arches which gives speed in erection and dismantling.
2. Rink boards—a fiberglass, laminated plywood and heliave-welded aluminum supports; portable.
3. Refrigeration—a less expensive procedure which makes better use of the by-products of heat and refrigeration; secretionary.
4. Maintenance and management—the company will staff and operate if necessary to help things get going.

SKI AREAS

Balosky, Patricia. Introduction to skiing on dry land. **Journal of Health, Physical Education, Recreation** 43:62, Jan. 1972.

A dry land skiing unit has been taught for several years in a California high school to expose students to fundamentals of skiing in areas where snow is unavailable but ski areas are accessible.

Gazette, Peggy C. Constructing skiing facilities. **Journal of Health, Physical Education, Recreation** 40:89, Feb. 1969.

The author outlines the steps that the Ohio State University took when first initiating a skiing program. These included provisions for the weather, snow-making equipment, ski equipment, size of classes, availability of instructors and provisions for recreational skiing.

Gockton, Linda; Jenkins, Bell; and Risser, Julia. Skiing without snow. **Journal of Health, Physical Education, Recreation** 39:100, Oct. 1968.

The authors explain that a skiing program within the physical education department need not be cancelled because of lack of facilities or equipment. Equipment may be purchased or rented inexpensively, and a plastic mat 9 by 24 ft. on a 25 percent grade will serve sufficiently well for a beginners' course.

Riley, J. T. Ski hill from garbage dump. **Parks and Recreation** 3:36, Nov. 1968.

The article presents a solution to a problem facing large communities such as the Borough of Etabioke near Toronto, Ontario. This community used refuse to construct a ski slope of 250-500 ft. with a 15°-33° gradient.

Zingale, Donald P. A skiing facility for the college physical education program. **The Physical Educator** 29:3-5, March 1972.

With today's college students turning more and more to skiing as a leisure time activity, this Ohio State University author outlines a program suited for adoption in any university or college. Special attention is given to the terrain available, type of snow, recently developed surfaces, ski tows and lighting for night skiing.

SWIMMING POOLS

Adkins, E. J. Pool built by team effort. **Times Educational Supplement** 2864:83, April 10, 1970.

This article emphasizes the do-it-yourself approach to pool facilities development. Although it demonstrates the economic savings realized by the use of community resources, it fails to delineate the administrative headaches involved in planning and constructing such facilities through community involvement.

A swimming pool gets second life. **Parks and Recreation** 6: May 1971.

When the Greensburg, Pa., YMCA decided to build a new Olympic size pool it did not want to lose the use of its old pool. So a new aluminum liner was added to the old pool which brought it to a depth of 42 in. and it is now used as a training pool.

Houston, Lawrence E. Portable pools for water safety programs. **American School and University** 39:86, May 1967.

The author contends that since portable swimming pools are inexpensive, there is no reason why every school district cannot have a water safety program to teach children the basics of swimming.

Learner pool teaches kindergartners to swim. **American School and University** 45:32, Aug. 1973.

This article concerns the nation's current emphasis on encouraging lifetime sports. Instructors at the Davis Elementary School in Grinnell, Iowa, are teaching kindergartners to swim by using a "miracle learner pool" designed specifically for instruction rather than for recreation. It allows for charted classes, a charted bottom which makes group control easy, uniform depth, adjustability and heated water. It may be installed for less than $5,000 and is movable.

Levenson, S. Swimming pool hazards. **Times Educational Supplement** 2943:51, Oct. 15, 1971.

The author cites lack of experience in chemical use as a main reason for the incorrect use of chemicals in pools. The article lists many hazards and the corresponding corrective measures for each one.

Odenkirk, James E. Inland surfing. **Journal of Health, Physical Education, Recreation,** 41:26, Nov.-Dec. 1970.

The development of an inland surfing facility for recreational and educational purposes, with implications for future use, is the subject of this article.

Pool maintenance costs plunge with automatic controls. **American School and University** 44:22, Dec. 1971.

The author declares that pH and chlorine controls will save the pool operators money. Automation and unqualified, transient pool operators make the initial $5,000 investment for the controller worth the expense.

Pools for schools: Great Britain. **Times Educational Supplement** 2915:54, April 2, 1971.

After justifying the need for a swimming pool in all schools, the author advises readers on the correct steps in acquiring a pool. A discussion of choosing, financing and maintaining a pool makes up the bulk of the article. Two supplementary articles discuss reasons for both an elementary and an advanced pool and for hydrotherapy.

TRACK AND FIELD AREAS

Air-inflatable track facility for winter use at Harvard. **American School and University** 42:32, May 1970.

Harvard University has a new 45,000 sq. ft. vinyl-coated nylon track facility that costs less than 10¢ per cu. ft. Manufactured by Air-Tech Industries, it can be inflated in 15 minutes.

Browne, Robert Lee. Innovations in sport facilities. **American School and University** 44:24, Nov. 1971.

This article deals with trends in multipurpose structures, especially those with spacious interiors. Space is spoken of in terms of modules of 60 to 120 ft. and 120 to 240 ft. Synthetic surfaces are the key to multi-use structures, and low maintenance cost can justify the initial expenditure. Development of domes and arched structures and air-supported or cable-supported buildings are also discussed. Diagrams of track and field layouts are included.

Gardner, John C. Tender loving care for athletic fields. **American School and University** 44:6, Nov. 1971.

The author discusses the problems of maintaining athletic fields. Specific instructions on cutting, seeding, fertilizing and lining fields are given as well as suggestions for watering systems.

Jones, Thomas. **How to Build a Track.** Madison: University of Wisconsin, 1955.

This book goes into the details of track construction, such as site, body of track, measurements, care and indoor tracks. Because of the date of publication it does not cover the new synthetic surfaces.

Kahler, Robert W. Northern Illinois' ten-lane track. **Scholastic Coach** 37:30, Jan. 1968.

The author describes Northern Illinois' physical education plant, which is underneath the football bleachers, and the all-weather composition track, which has 10 lanes. Field events are held inside the track area.

Report on running tracks. **Journal of Physical Education,** p. 119, May-June 1968.

The need for indoor track facilities as well as their initial cost and maintenance costs are presented in this article.

Track and field layouts. **American School and University** 44:26, Nov. 1971.

A square track plus artificial surfacing can accommodate what used to be three separate areas in far less space. Converting the track to a square and changing the measurements to the metric system are helpful suggestions to utilize when space and funds are at a premium.

Turner, J. Bruce. Five years of utopia. **Athletic Journal,** p. 56, Nov. 1966.

The author discusses many advantages of a track made of the synthetic surface Resilite.

IV. ENVIRONMENTAL CONSIDERATIONS

ACOUSTICS

Solving acoustics problem in swimming pool area. **American School and University** 42:36, Nov. 1969.

The Evergreen Park High School Olympic-size pool and smaller diving pool presented an acoustical problem because the bricks and tile reflected sound. The problem was solved by placing approximately 2,200 geocoustic units on the walls and ceilings, which required about 30 hours' work.

COOLING AND HEATING

Farrell, Ranger. Selecting heating and cooling systems. **American School and University** 44:18, Jan. 1972.

Types of current heating systems are discussed. The problems of temperature, humidity and ventilation define the heating system needed. Points to consider in choosing a system are source, conversion, distribution and room environment.

Infra-red radiant system heats this gym at low cost. **American School and University** 42:57-58, Jan. 1970.

This article describes an infra-red heating system in a large gymnasium which has many advantages over conventional central heating.

Solar shield cuts glare and build-up of heat. **School Management** 15:31, March 1971.

The article describes a louvered-type awning which reduces glare and heat buildup while allowing light to pass through.

LAYOUT DESIGN

Architect's aide: A computer. **American School and University** 44:43, Nov. 1971.

Computers can be used in planning the layout of a school. Included in the data are the number of students enrolled per day, students per period, distribution, movement volume, cost and area needed.

Caudell, William. What works and what fails in school design. **Nation's Schools** 79:85, March 1967.

This article contains over 100 design ideas actually used in elementary and secondary schools by an architectural firm. The innovations and design features in the schools were considered excellent when first built; some, however, became flops.

Feild, David A. National Art Museum of Sport. **School Arts** 70:40-43, March 1971.

The author describes the National Art Museum of Sport, which combines art and sport.

Mittelsteadt, Arthur H., Jr. Planning school grounds. **Journal Of Health, Physical Education, Recreation** 40:37, May 1969.

The author discusses in detail the importance of a master plan when initiating school ground areas. He discusses the responsibilities of professionals in various fields in relation to physical education, recreation and outdoor education.

O'Donnell, Dennis H. Physical education program specifications a must in facility planning and design. **Journal of the Canadian Association for Health, Physical Education and Recreation** 38:3, March-April 1972.

The author places a major responsibility upon the specifier, with a close working relationship with the owner, for, he maintains, "too many seemingly minor mistakes have been made in the past to justify continuing in this fashion" (where architect or engineer and owner make all decisions). O'Donnell outlines five major factors affecting physical education facilities—location, environment, equipment, behavioral patterns and group size. In addition, recommendations are made regarding building specifications, building job flow, communication devices, program specifications, specification order, research, difference in physical education buildings and requirements of good program specifications.

Peterson, Fred A. Recreation building boom. **Parks and Recreation** 7:34-35, May 1972.

This article suggests an economical way to deal with the necessary increase in the building of recreation facilities—prefabricated metal structures—and discusses the advantages of this type of building. Included are several examples of such structures in Peoria, Ill.; Monroe, Wash.; and Sarasota, Fla.

Planning outdoor areas for athletics and recreation. **American School and University** 39:23, Aug. 1967.

The article suggests the following criteria should be considered when planning an outdoor physical education facility: feasibility, seasonableness, progression and variety.

Smith, J. Austin. Use the air space above auditoriums for needed recreation complexes. **AudArena** 2:20, Winter 1968.

Citing examples, the author maintains that because of the scarcity of land in the United States public recreation facilities in urban areas should be built in the relatively unused space above auditoriums and large urban buildings.

Sullivan, James and Weatherill, Robert H. Gym design and construction. **Scholastic Coach** 37:7, Jan. 1968.

The authors explain that careful planning must go into gymnasium construction and design. Two important considerations involved in the preplanning are reviewing the recent literature on construction and traveling as much as possible to other facilities. The plans for the physical education building at the University of Maine are illustrated.

Surge in aquatic education demands new design guides. **Nation's Schools** 3:104, Feb. 1969.

The article stresses that certain guidelines are needed before an aquatics area is designed. Such factors as the amount of water needed, the size of the area and its depth, the shapes of pools, and the use of a multiple-unit type of facility are discussed.

Theibert, P. R. The possible dreams. **Scholastic Coach** 37:10, Jan. 1968.

Theibert says that facility planners for physical education and athletic plants must use money wisely, taking into consideration the many new products and new concepts, particularly in regard to the new indoor and outdoor surfaces.

LIGHTING

Alschuler, Alfred S. and Kamarath, Karl. Courts, clubs and construction. **World Tennis** 20: June 1972.

This article gives short answers to the questions of: the effectiveness of mercury vapor lamps, the advantages and disadvantages of concrete courts over asphalt, and the planning, organization and operation of tennis clubs.

Bartow beefs up lighting in football stadium. **American School and University** 42: Dec. 1969.

The addition of floodlights to replace higher watt lights enabled a school to improve the lighting and reduce expenses. This article gives a helpful hint on lighting economy.

Gloster, Charles D. Indoor tennis lighting: The facts and fictions. **World Tennis** 19:32, May 1972.

The author offers a concise discussion of the basic needs of indoor tennis lighting and methods for meeting those needs. His best suggestion is that of providing a direct-indirect type of system.

Indirect lighting system for new geodesic dome sports center. **College Management** 7:35-36, June 1972.

Centenary College of Louisiana has a new geodesic domed sports center with a unique indirect lighting system providing brilliant, uniform, glare-free illumination with reduced maintenance. Ceiling height negated the possibility of employing a conventional lighting system. However, contract specifications of a 65 percent light reflectivity factor from the acoustical insulation applied to the interior surfaces of the geodesic dome made indirect lighting feasible.

Lighting for a championship softball field. **The American City** 87:122, Oct. 1972.

This brief article tells how York, Pa., secured the best lighting for its championship softball fields. An important asset of the article is a cost comparison chart of the lighting of Hoffman Field using three types of light sources. Overall the multivapor was the most economical.

Mercury vapor lighting. **College Management** 7:37, Jan. 1972.

The Wide-Light Corporation installed fluorescent lighting in the multipurpose gymnasium at the University of Vermont. The lights in the facility can be brightened for basketball games or dimmed for dances or concerts.

National Electrical Contractors Association. Balancing lighting and thermal designs. **American School and University** 42:29, April 1970.

The Association describes differences in heat radiated to occupants and room surfaces through incandescent and fluorescent lighting. Height of ceiling, need for reading light and activities in the room must be considered.

Oaks, Howard A. Lights, lights, lights. **Parks and Recreation** 5:43, Jan. 1970.

The expanding need for outdoor recreation areas has created a need for different types of outdoor lighting. This article discusses major types of lighting and the uses of each.

University of Pennsylvania illuminates pool for telecasts. **American School and University** 42:29, March 1970.

This article tells how the University of Pennsylvania used enough light for TV without making the glare or heat uncomfortable for swimmers or spectators.

Williams, H.G. A new light on sports. **American School and University** 40:26, Aug. 1968.

Since more emphasis is being placed on physical education and athletics in schools, and since television coverage of these events is also increasing, it is important that adequate lighting for television and film purposes be placed in indoor facilities.

MAINTENANCE AND REMODELING

Applegate, Lindsay M. Saving the old gym floor. **School Management** 16:34, April 1972.

This article explains how a high school gymnasium floor which had buckled in many places because of a concrete slab saturated with moisture was remodeled without the inconvenience of tearing up and replacing the whole floor and baseboards.

Asheley, Warren H. Six reasons why. **School Management** 17.17, Sept. 1973.

Ashley cites at least six good reasons for carefully considering the possibilities of "recycling" buildings before deciding on new construction.

Brosmith, Bert and Juster, Howard. Should we renovate, remodel or demolish? **American School and University** 45:18-28, March 1973.

American School and University interviews architects Juster and Brosmith about the pitfalls of school and college remodeling, especially in regard to cost and space.

Graves, Ben E. Repair or replace: Here's how to decide. **The Education Digest** 38: Oct. 1972.

The author states certain areas that architects should deal with before making a decision to modernize. He also gives three easy lessons on modernization that can save dollars and disappointments.

Hampton, Clark. Gym floor in perfect condition after eighteen years. **School Management** 15:43-44, May 1971.

The article describes the maintenance of a gymnasium floor by a disking and recoating program that eliminates the necessity to strip or sand. Merchandise information is also included.

Karabetos, J. Facilities for the 70's. **Physical Educator** 27:171, Dec. 1970.

The author asserts that a basic fault in facility development is lack of planning by those who will use the facilities. Innovative planning is the only recourse with problems such as overcrowding and new curriculum development faced by all.

Keller, Roy. Making the most of your old facilities. **Journal of Health, Physical Education, Recreation** 42:26-28, June 1971.

This article offers many suggestions for maximum use of available facilities. It describes the University of Illinois space utilization office through which the University's physical education facilities are controlled.

Mercersburg Academy's "Operation Update." **Scholastic Coach** 39:11, Jan. 1970.

"Operation Update," staged at Mercersburg Academy in Pennsylvania, involved adding 41,000 sq. ft. of space to the existing 58-year-old building, which now includes three regulation basketball courts, a nine-lane pool, indoor facilities for fencing, wrestling, track and squash, and adjunct facilities for baseball, football, tennis and track.

Rehabilitating campus buildings—Is it worth the effort? **American School and University** 43:30, July 1971.

The value of rehabilitating a building depends on the building itself. Most old ones have definite assets—unique architecture, thick walls, few windows—which can mean a 30 percent saving over the cost of a new building. Several examples of rehabilitative projects are given.

Remodel the armory or build a new gym. **American School and University** 43:49-51, Dec. 1970.

This article tells how a college official went to an architectural firm to determine the most economical way to update the college's physical education and athletic facilities. The survey showed that for $4 million the school could build a new 76,000 sq. ft. complex, while spending $3 million on the armory would yield 170,000 sq. ft. The article points out the need to explore all avenues of expansion rather than say the only solution is a new building.

West Virginia University sports coliseum. **American School and University** 43:34, Nov. 1970.

A design of 40 ribs radiating from the center of the coliseum's roof creates a continuous hill and valley effect. This design demands flexible roofing material; foam was used and found suitable as insulation and weatherproofer.

V. SYNTHETIC SURFACES

INDOOR

Ashley, John A. Protecting the gym floor. **Scholastic Coach** 41:46, Jan. 1972.

The author speaks of the vinyl Tuff-Spun matting which Wooster College (Ohio) purchased to protect the new gymnasium floor. The gymnasium is used for numerous activities and thus had to be protected from spike heels, metal heelplates, chairs, tables and gym equipment. Vinyl is working well and is helping the college to avoid possible refinishing or replacement.

Picking the right floor. **American School and University** 45:27 Sept. 1972.

Although not specifically related to physical education facilities, this article compares carpet vs. tile vs. terrazzo on installation, maintenance costs, wear and suitability.

Seitz, Edward. The synthetic surface revolutions. **Scholastic Coach** 39:22 Jan. 1970.

The author relates how synthetic surfaces, especially for basketball and track, are the coming thing and that within 10 years "it will be difficult to find anything but a synthetic surface specified for new installations." Some advantages of these new surfaces are listed.

Spreading the good word about indoor-outdoor surfacing for sports. **American School and University** 40:33, Aug. 1968.

The article accomplishes its goal of "spreading the word" about both indoor and outdoor surfacing for physical education, athletics and playgrounds.

Synthetic covering for college field house. **American School and University** 42:18, Aug. 1970.

A synthetic covering was added to the new field house at Lynchburg College in Virginia. Because of the new surface, many different activities can be held, e.g., basketball, tennis, track, indoor touch football, indoor soccer, volleyball and badminton.

Synthetic gym floor enhances both function and design. **School Management** 15:42, Aug. 1971.

This short article gives the advantages of no dead space, a sound muffler to the rest of the school, and a uniform surface to play on. A Tartan floor is rated as an investment in the long run by a principal of a high school that installed such a floor.

Theibert, Richard P. A primer on synthetic surfaces. **American School and University** 43:44, Aug. 1971.

The author asks readers to consider all types of artificial surfaces and gives reasons why surfaces can be helpful for today's needs: resiliency, guaranteed performance, immunity to fire and multi-use. He cites a number of problems which can arise when using such surfaces and describes various methods of installation.

Woods, Herbert W. Vinyl flooring: The surfacing of the future. **Athletic Journal** 53:16, Dec. 1972.

This article details the manner in which vinyl flooring should be constructed and explains the use and advantages of epoxy glues.

OUTDOOR

And the green grass grew all around. **Scholastic Coach** 40:13, Jan. 1971.

This article briefly tells about the installation, benefits and uses of Astroturf, Poly-Turf and Tartan turf. Each is discussed separately and not compared as such.

Buskirk, Elsworth R.; McLaughlin, Everett R.; and Looms, Joseph L. Microclimate over artificial turf. **Journal of Health, Physical Education, Recreation** 42:29-30, Nov.-Dec. 1971.

The authors conducted a study of temperatures over artificial turf as compared to those over a natural grass field. Their findings indicate significantly higher temperatures over the artificial surface.

Johnson, William. Goodby to three yards and a cloud of dust. **Sports Illustrated** 30:37, Jan. 27, 1969.

With the increased use of outdoor synthetic fields, we may indeed see the day when we can say "goodby to three yards and a cloud of dust." The article contains diagrams of the essential differences between two synthetic fields—Astroturf, by Monsanto Chemical Corporation, and Tartan turf, by the 3M Company.

Lashbrook, Lynn. The facts about fake grass. **Journal of Health, Physical Education, Recreation** 42:28-29, Nov.-Dec. 1971.

A graduate student discusses his survey of football stadiums using artificial turf. It appears too early as yet to speculate on the turf's relationship to injuries, but many of its other advantages are listed.

Mills, George E. Site planning for outdoor fields. **Scholastic Coach** 40:42, Jan. 1971.

This general analysis of how Schoolcraft College in Detroit planned its outdoor facilities suggests a five-point approach to facility planning:

1. Follow the master plan of the campus.
2. Hire a landscape architect before the building is built, not after.
3. Determine program needs.
4. Establish basic design based on contour and type of area.
5. Finalize construction drawings.

Morris, Xenophon. James River Park. **Parks and Recreation** 7:19-21, Feb. 1972.

This article deals with the construction of James River Park in Richmond, Va. It shows the preplanning, overall planning, actual work and future planning involved in developing this recreational area. It is an excellent illustration of the many areas of work required for such a project.

Multipurpose stadium boasts roll-up football field. **American Schools and University** 45:79, April 1973.

The world's first one-piece, portable football field laid down and removed mechanically (in about one hour each way) has been installed in New Idaho Stadium at the University of Idaho, Moscow. The new stadium and 74,000 sq. ft. portable Tartan turf installation represent Phase I of a plan to provide the university with one of the finest multipurpose sports facilities anywhere.

With the turf rolled up, the stadium provides for basketball, tennis, badminton, volleyball and track. When rolled out, football, baseball, golf and soccer may be played on it.

Newbold, Bill, Sekuylkill Valley Nature Center. **Parks and Recreation** 6:14-18, Feb. 1971.

This facility is designed to meet the outdoor needs of the urban population of Pennsylvania. Outdoor education for adults and students is emphasized.

P. Richard Theibert on facilities for lifetime sports. **American School and University** 44:14, Nov. 1971.

Defining, discussing and exploring the standard facility used for typical collegiate physical education, Theibert explains and designs a new structure. A membrane-type building houses all types of sports activities with related interests, such as swimming and skating, in the same general area. The author points out the feasibility of year-round use.

Texas District finds success with synthetic playing field. **American School and University** 45:30, June 1973.

This article discusses a Dallas school district which installed synthetic surfaces on three of its six high school fields. This was done after a survey of injuries had been made. Safety, maintenance and field use are elaborated upon.

Thompson, Hans A. Seattle's over the freeway park. **Parks and Recreation** 7:36, June 1972.

Thompson tells of a unique urban park under construction in the heart of downtown Seattle. It will cover a major interstate highway and feature a series of cascading waterfalls set in the freeway's median strip. Drawings and advantages of parks are discussed.

Underwood, John. New slant on the mod sod. **Sports Illustrated** 35:32, Nov. 1971.

This article traces the rise of Astroturf, Tartan turf and Poly-Turf to national prominence. Synthetic grass, which was to be a problem solver for such perennial problems as temperature, weather and maintenance costs, has become a problem creator in the eyes of the writer.